Design Engineering

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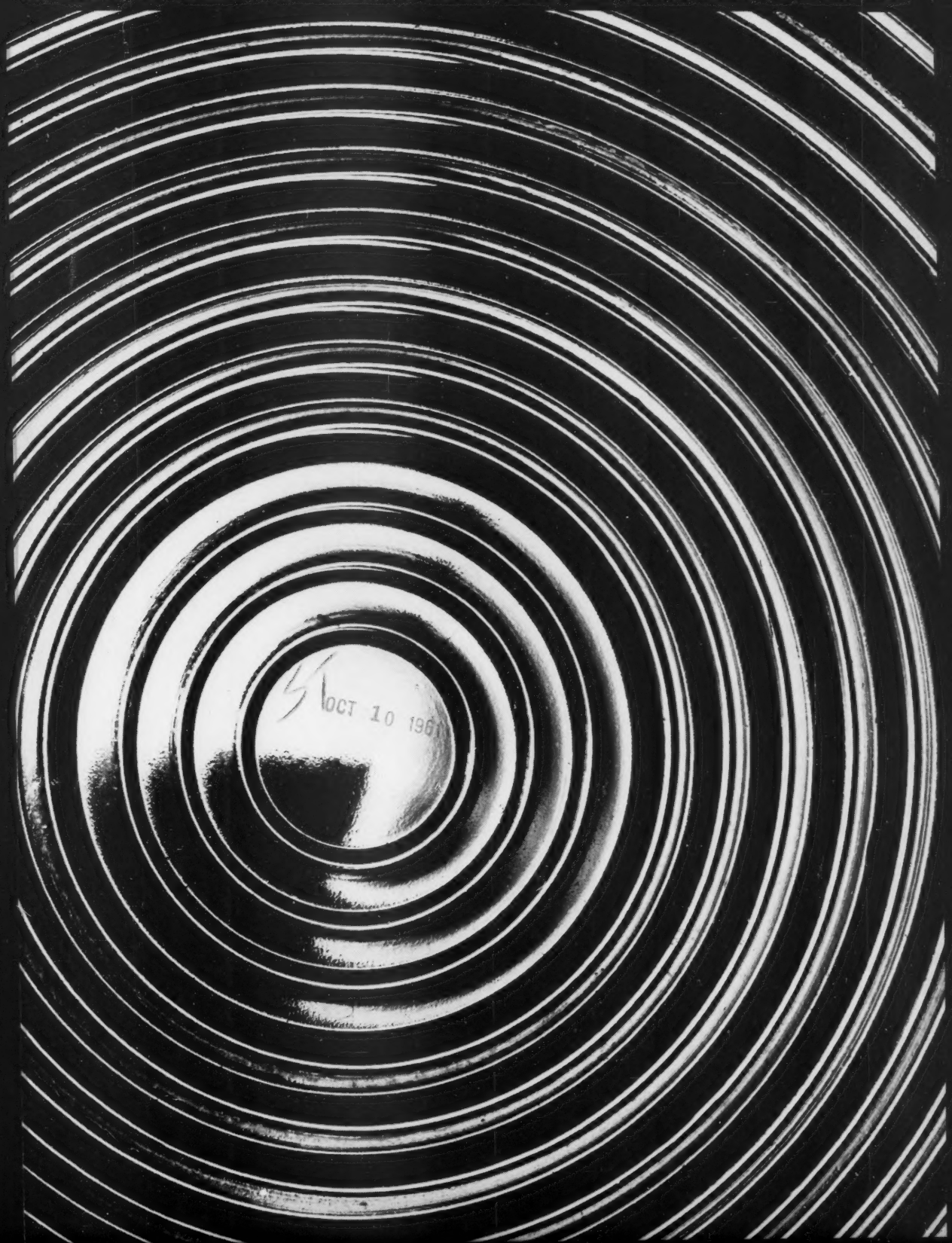

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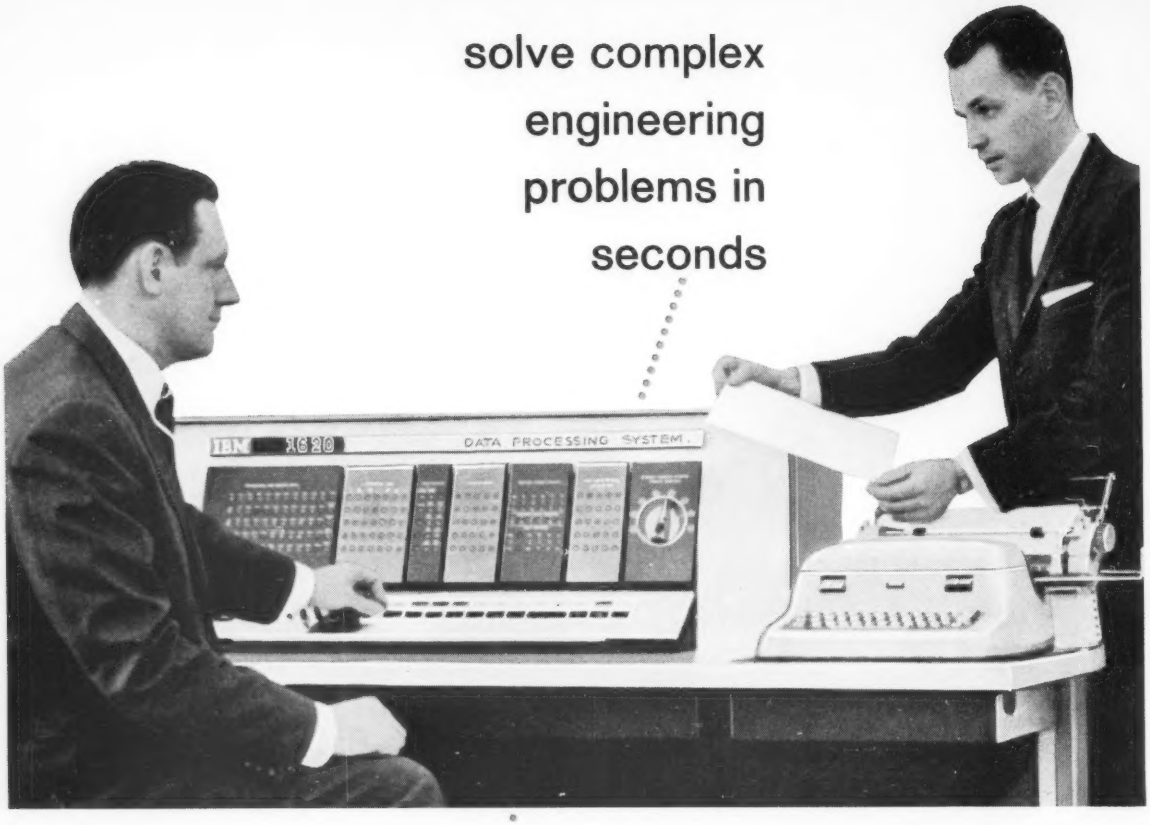

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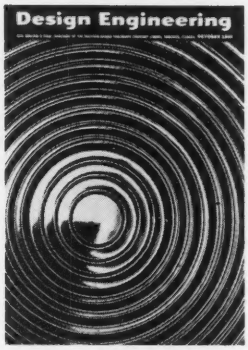
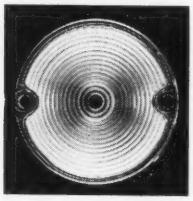


This month's cover

All eyes are on plastics this month as the first edition of the Plastics Show of Canada is unveiled in Toronto. Our cover, too, unveils something new in plastics — it's a taillight lens from one of the new 1962 model automobiles. The lens is by Smith and Stone Ltd of Toronto, and photography by Ron Vickers, A.R.P.S. For more information about the plastics show refer to page 53, and for a full picture of the lens, see below.



In this issue

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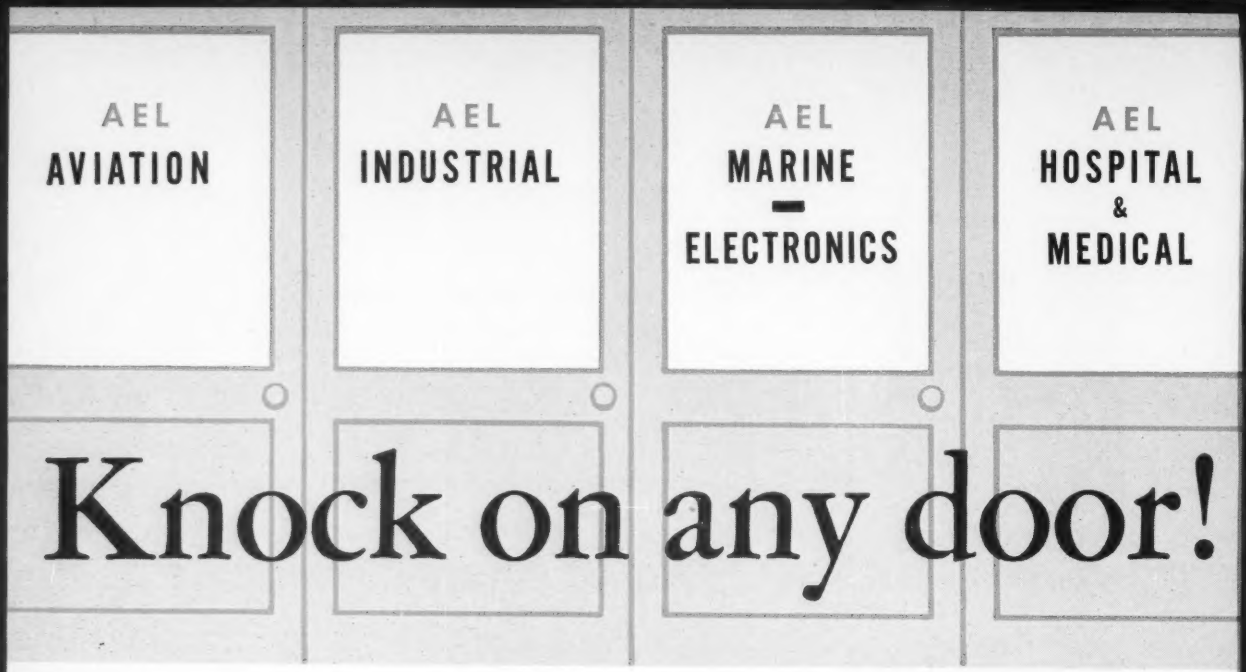

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DE forecast:

1961 original equipment production may prove better than expected

Canada's original equipment industries should ship goods worth $7.92 billion from their factories in 1961 . . . a mere 3% less than last year. In view of the economic recession just past, this apparently small slide augurs well for the year ahead.

For the figures, DE's own research bureau has dug deep into its dusty DBS records, gleaned many up-to-date facts of its own and dropped into our editorial basket what is perhaps the first detailed survey of Canada's OEM ever made available for general use.

As a barometer, only industries manufacturing products at an engineering level were considered. Consequently figures for research and development work were not included. But it must be remembered that R&D consumption would add handsomely to the market level.

Five main industrial categories were considered: iron and steel products, transportation equipment, electrical apparatus and supplies, non-ferrous metal products and miscellaneous products.

Iron and steel has been the saving factor in keeping 1961's figures reasonably respectable. Our research bureau says "Primary iron and steel's position is expected to become much stronger after a slump in the first six months of 1961, and predictions are that production may reach record levels for the rest of the year." The value of factory shipments should rise 1% from 1960 levels with an increase in office, household and store machinery of 20% over 1960. However wire and wire goods may show a slide of 10%.

Shipments in transportation equipment are expected to decline 12% in 1961 compared with the previous year. The most significant loss should be in rolling stock, a slump of 26%.

The electrical apparatus and supplies industry may record a 6% loss in 1961 from 1960. The largest decline should occur in heavy electrical machinery and equipment (15%); however batteries may show a 12% gain.

In the non-ferrous metal products industry there should be a slight decline of 1%. Non-ferrous metal smelting and refining may slip 3% but jewelry and silverware should come out with a gain of 3% over last year.

The value of factory shipments in the miscellaneous industries (clocks to umbrellas) is expected to increase 10% this year over 1960, with a 15% increase in professional and scientific equipment.

So, although some sectors of industry have reason for gloom, there still seems to be a certain demand for design engineers in the near future. That's the main thing.

Looking at the over-all picture is less encouraging but 1961 shows promise of being much better than 1958.

For your calendar

October 9-12: Annual Instrument Symposium & Research Equipment Exhibit, National Institutes of Health, Bethesda, Maryland.

October 10-12: National Conference on Standards, American Standards Association, Houston, Texas.

October 16-19: American Vacuum Society, annual symposium, Washington, D.C.

October 17-19: The Plastics Show of Canada, Automotive Building, Exhibition Grounds, Toronto.

October 19-20: National Conference on Industrial Hydraulics, Sherman Hotel, Chicago.

October 25-28: Illinois Institute of Technology, computer applications symposium, Chicago, Ill.

October 29-November 1: National Metal Trades Association, annual convention, Hotel Commodore, New York.

November 6-8: Chemical Institute of Canada, chemical engineering division conference, Royal York Hotel, Toronto.

November 13-16: International Conference on Magnetism and Materials, Westward Hotel, Phoenix, Ariz.

November 13-18: 2nd Engineering Materials and Design Exhibition and Conference, Earls Court, London, Eng.

November 26-December 1: American Society of Mechanical Engineers, winter annual meeting, Statler Hilton Hotel, New York.

December 7-9: Canada's Power Show, Queen Elizabeth Building, Exhibition Park, Toronto.

Fiberglas Reinforced Plastics have the greatest strength-to-weight ratio of any known material. And other remarkable qualities make them one of the most versatile and economical materials for a wide variety of applications . . . in the development of new products . . . to improve present products or processing equipment.

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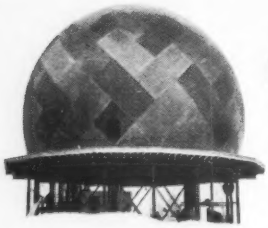

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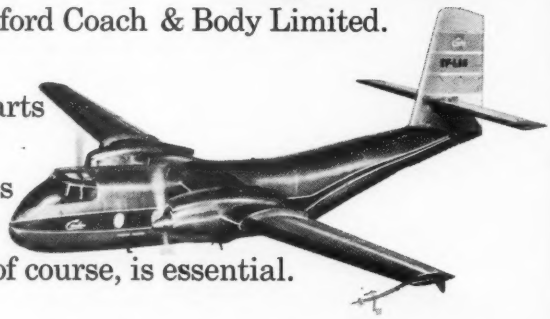

The 500 or so Fiberglas Reinforced Plastic parts that go into the de Havilland Caribou are a good example of the way specialized shapes can be produced inexpensively in limited quantities. A strong, lightweight material, of course, is essential.

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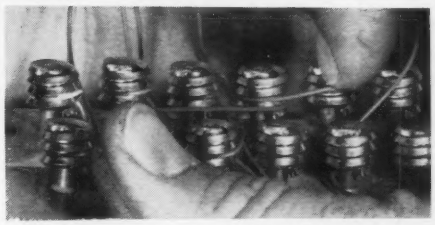
Reports — A world roundup of engineering and design interest

New terminal connectors replace binding posts and nuts



A new connector, which looks like a coil spring, has been developed for connecting plastic-insulated small-gauge wires, to terminal posts, primarily in terminal boxes for telephone poles and basements. The new spring connector allows rapid connection of wires without first stripping the insulation, and without disturbing other wires connected to the same post.

Although the connector looks like a coil spring, the spring wire is square-shaped instead of round or oval. When insulated wire is looped around the spring once and pulled tight, the wire is forced between two turns of the coil. The sharp square edges of the connector bite through the plastic insulation and make multiple contacts that are both electrically stable and vibration-proof. Other wires can be forced into other turns of the coil spring.

The connector is made of tin-plated phosphor bronze wire about 1/16 inch square. It is wound into a coil of about ⅜ inch outside diameter. A brass post through the centre of the coil supports it and attaches it to the terminal block. The first terminal design has two rows of coil spring connectors and will be used initially as multiple terminals for offices and apartments. They are being produced in the U. S. for telephone companies. *Source: Bell Telephone Laboratories.*

Minimizing water-drop erosion in steam turbines

Research scientists are shooting "bullets" of water into solid blocks of steel to study water-drop erosion on whirling steam turbine blades and the surfaces of high-speed aircraft and missiles winging through rain. To produce the supersonic water bullets, a small lead pellet is fired down a 30 inch metal tube by gas pressures of about 150 psi. When the pellet strikes a small sealed reservoir of water it squeezes out a jet through a tiny orifice aimed at the metal sample. Traveling at 3,400 mph the water slug crosses the one-inch gap in about 15 millionths of a second, and is studied by a camera which snaps it at intervals as short as 5 millionths of a second.

Analysis of the metal surfaces shows the jets to have formed tiny craters with a profile like those produced by meteorites crashing to earth. A numerical scale is now being devised to attach quantitative values to the erosion damage. Other facts uncovered are:

- Uniform jets have a smooth leading face and cause more damage than irregular-shaped jets.
- Irregularities in the metal surface have little effect on erosion damage.
- Thin films of water or oil do not protect the metal surface.
- Visible damage, barely seen on the surface, appears to correspond to the actual threshold of water erosion damage experience in operating steam turbines.

If this tentative correlation between experimental and operational damage can be confirmed, the water bullet should provide a fast, simple and inexpensive means for selecting erosion resistant materials. So far a cobalt alloy and tungsten carbide have shown greatest resistance to supersonic water bombardment. *Source: Westinghouse Research Laboratories.*

Giant Canadian crane designed for increased manoeuvrability

A 98,000 lb. crane, claimed to be the largest mobile crane built in Canada, is designed with emphasis on greater manoeuvrability and increased axle life. Capable of supporting a 150-foot boom with a 50-foot jib, it is suited to round-the-clock operations in severe rock and quarry applications. It's engine, governed at 2400 rpm together with a 4-speed drive transmission and 3-speed auxilliary transmission, enables it to operate at under 4 mph in spotting and work placing, and up to 30 mph on highways.

The crane is equipped with a 100-inch-track planetary bogie axle with a 13.724: 1 total reduction and planetary secondary reduction in the wheel hubs. The second reduction provides a smooth flow of power since it is as close as possible to the driving tires. Torque loads on all driving components are considerably reduced, stepping up axle life and minimizing repairs. Planetary drives also provide more ground clearance than standard double reduction axles. *Source: Crane Carrier Canada Ltd.*

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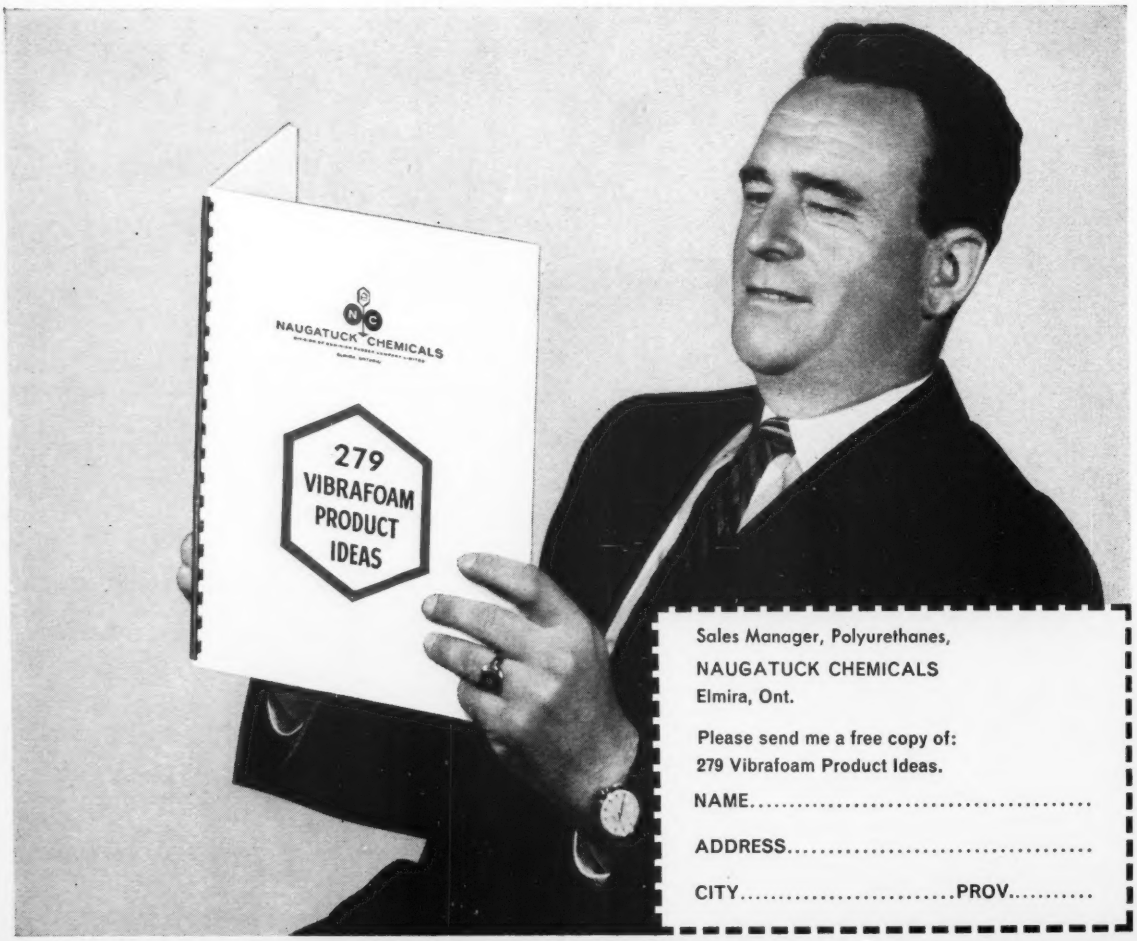

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Improved dielectrics by high-energy radiation

The electrical industry's need for improved organic insulation has spurred examination of new methods for producing or modifying suitable materials. One possible method, still in the early stages of development in Britain, employs ionizing radiations for initiating chemical reactions and altering the structure of compounds.

Radiation-induced chemical changes in organic or related materials have been known for over a century but commercial applications have been restricted by the limited power or penetration of the radiation from available sources. Now, with the advent of nuclear reactors, artificial isotopes and particle accelerating machines it has become possible to induce chemical changes on a commercial scale.

Radiation can initiate the free-radical polymerization of organic materials containing unsaturated bonds such as ethylene, acetylene, perfluoro-olefines and linseed oil. Polymerization of dimethylsiloxane or isobutene which appears to be dependent on an ionic mechanism can also be initiated and certain solid-state polymerizations can be induced such as the polymerization of acrylamide and vinyl stearate. As a result encapsulation of electrical components and absolute adhesion of solids are two practical possibilities.

Irradiation has also been found useful in converting a material from a moldable, fusible or soluble state into a more permanent state . . . reactions now achieved by curing, cross-linking, vulcanizing or thermosetting. One distinct advantage is elimination of heating, catalysis or prolonged atmospheric exposure, which are inclined to impair electrical properties by catalyst residue or thermal degradation.

Irradiation can be helpful in inducing scission of molecules into smaller fragments. This has practical application in foaming certain polymeric materials and controlling such properties as melt viscosity and solubility in polymers. *Source: Associated Electrical Industries Limited.*

Gold-metallized plastic as possible fuel container material

Laboratory tests have found that thin films of gold, chemically deposited on the interior of Teflon fuel bladders, reduce permeability to some high-energy fuels from 10 to as much as 1,000 times. Several missile manufacturers are now evaluating "gold-metallized" Teflon with exacting engineering and service tests to confirm its usefulness in solving one of the most difficult problems in fueling engines at zero gravity.

Bladders are usually made of Teflon and contained in an outer metallic or reinforced plastic shell, which serves as a pressure vessel. When the propellant is to be forced into the firing chamber, an expulsion gas is released into the outer shell, which collapses the bladder and forces the release of its contents. Yet, the slight permeability of some high energy propellants like fuming nitric acid, hydrogen peroxide, hydrazine and liquid oxygen has been a problem, particularly when the fuels have had to be contained for any appreciable time before firing.

Samples of the gold-metallized bladders now being evaluated contain gold films less than 1/1000 of an inch thick. Heat-transfer properties of the combination material are expected to be advantageous, in addition to the resistance of both gold and Teflon to moderately high temperatures thus enabling flash heat-treating or annealing. Another advantage is its electrical conductivity. For these reasons the gold-metallized Teflon is worth considering for other applications outside the aerospace industry. *Source: Quantum Incorporated.*

New clock 10 times more accurate than conventional models

A new experimental clock, using a quartz crystal, will keep time to within five seconds in every year. Powered by a single size D mercury battery which lasts about four months, the unit was developed as the result of research into the unique ability of a tunnel diode to change a high frequency signal into one of much lower frequency — a relatively difficult feat for vacuum tubes or resistors. Three tiny tunnel diodes convert the 100,000 cps crystal vibrations into a 50 cps current to drive the clock motor.

The tunnel diodes have proved so stable in operation that no inaccuracy can be ascribed to them. Any variation comes from the quartz crystal which changes frequency very slightly with temperature fluctuations. But the inaccuracy is only of the order of 5 seconds per year in a wider temperature range than would be encountered under normal conditions. With certain refinements in electronic design the developers hope for even greater accuracy. *Source: General Electric Research Lab.*


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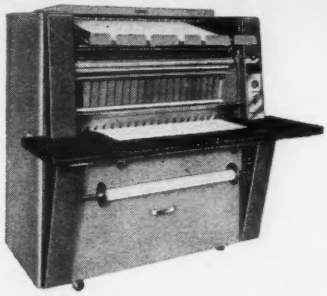

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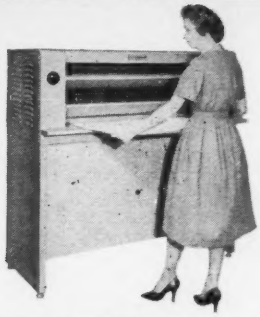

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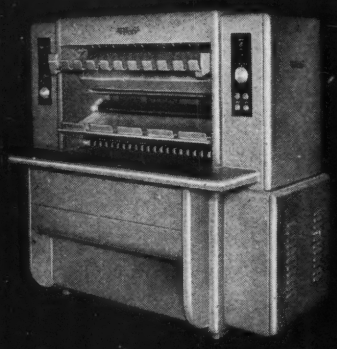

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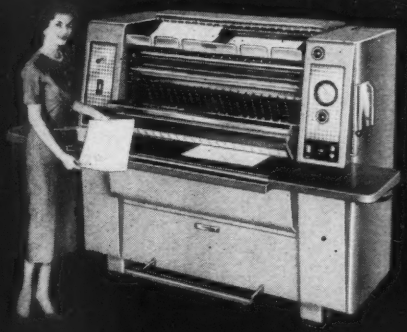

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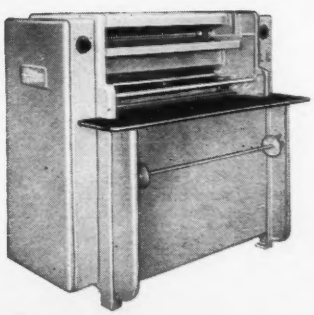

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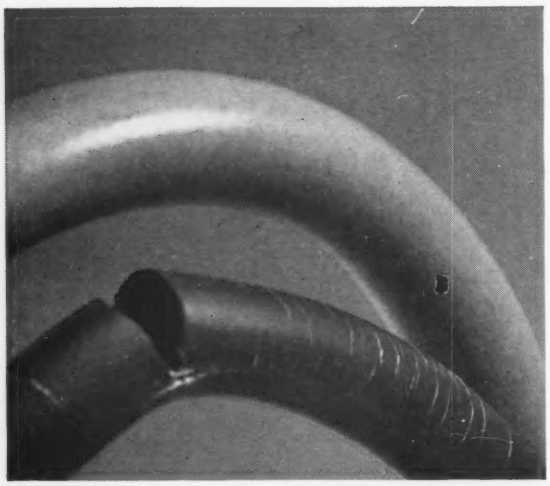
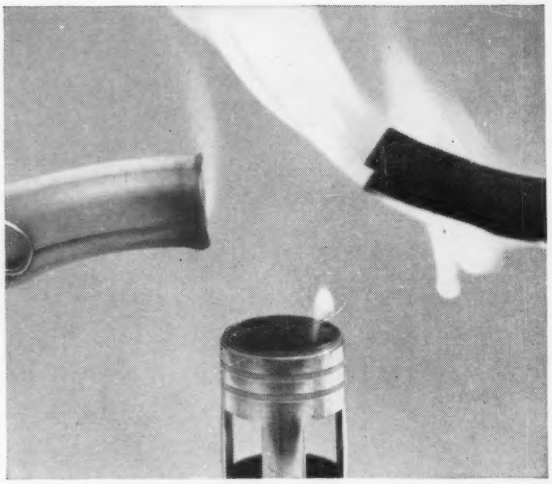


1. *HYPALON Is Ozone-Proof*

No other rubber can match it. Drain hoses above were exposed simultaneously to 15 PPM ozone for more than 5 hours under lab test conditions. Ordinary rubber hose (bottom) developed severe cracks, split when bent. HYPALON-veneered hose (top) remained tough, lively, *crack-free.*



2. *HYPALON Is Flame-Resistant*

Gives appliances an important safety bonus because it will not support combustion. In a test exposure to open flame, HYPALON door seal (left) extinguished itself as soon as flame was removed. Seal made of ordinary synthetic rubber, however, continued burning.

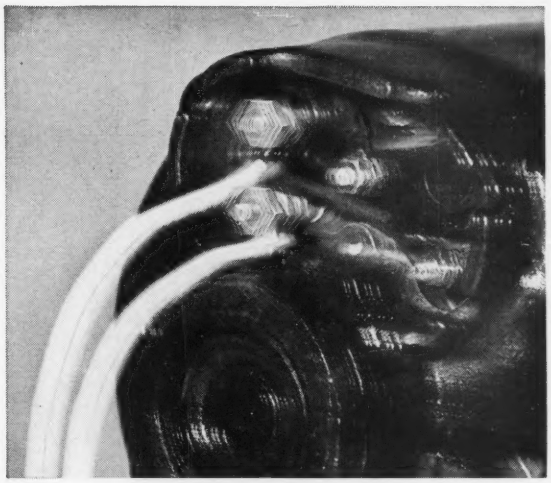
The outstanding combination of properties of HYPALON — not offered by *any* conventional synthetic rubber — makes it an ideal material for "service free" appliance design. HYPALON has proven especially successful in applications where severe operating conditions shorten the life of ordinary rubber parts.

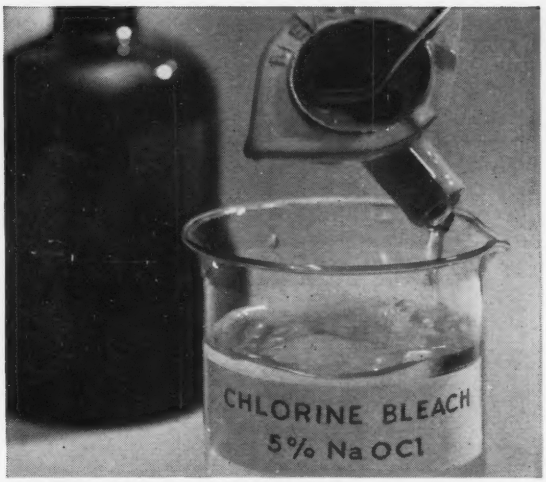
Exceptional resistance to ozone, flame, abrasion and chemicals, plus *permanent* colourability, are just a few of the reasons why HYPALON is specified for key resilient components by many leading appliance manufacturers. There are others — such as excellent resistance to temperature extremes and good electrical characteristics. HYPALON is currently lengthening the life of such parts as bleach tubing, drain hose, seals, gaskets, electrical wire and other resilient moulded and extruded parts.

Investigate the design advantages of HYPALON in the appliances *you* design and manufacture. For detailed information, send for our free booklet discussing properties and applications. Clip and mail the handy coupon today. Or just write: Du Pont of Canada Limited, Elastomers, 85 Eglinton Avenue East, Toronto 12, Ontario.

HYPALON CAN SERVICE INTO APPLIANCES

Prevents Breakdown of Key Resilient Parts. Here's Why:





3. *HYPALON Is Durable*

Parts stay tough and lively, afford long, reliable service because of excellent resistance to abrasion, flex-cracking, extremes of temperature. HYPALON is ideal for lead wires on motors and compressors where exposure to constant vibration, ozone, heat, oil and grease is common.

4. *HYPALON Resists Oils and Chemicals*

Outstanding resistance to strong oxidizing chemicals suits HYPALON for prolonged contact with concentrated bleach solutions. HYPALON resists dyes, wet steam, household ammonia, detergent-laden wash water . . . performs well in contact with food chemicals, lubricating oils, many solvents.

AND...HYPALON Is Colour Stable

Can be compounded in white and an unlimited array of bright and pastel shades to complement appliance styling, enhance sales appeal. Colours are stable and durable, stay bright and fresh. Even weather and sunlight won't cause them to fade or darken.

DU PONT CANADA **HYPALON*** SYNTHETIC RUBBER

BETTER THINGS FOR BETTER LIVING
... *THROUGH CHEMISTRY*

Du Pont of Canada Limited, DE-10
Elastomers,
85 Eglinton Avenue East,
Toronto 12, Ontario.

Please send me, without obligation, more information on Du Pont HYPALON synthetic rubber.

Name_____

Firm_____

Address_____

City_____ Zone____ Prov._____

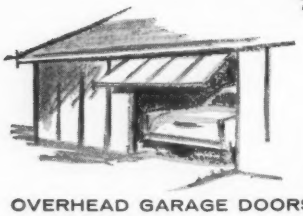
Registered Trademarks of E. I. du Pont de Nemours & Co. (Inc.)

For further information mark No. 122 on Readers' Service Card

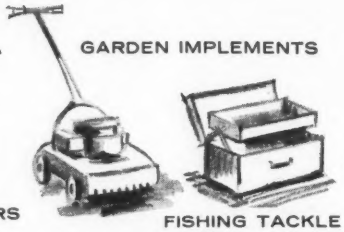
COLOURB

CONTINUOUSLY GALVANIZED

Easy forming...rust defying....



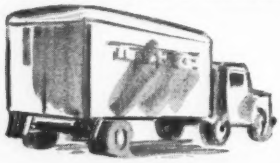
OVERHEAD GARAGE DOORS



GARDEN IMPLEMENTS

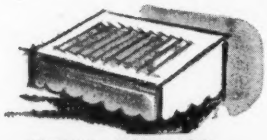
FISHING TACKLE AND TOOL BOXES

INSIDE PARTITIONS

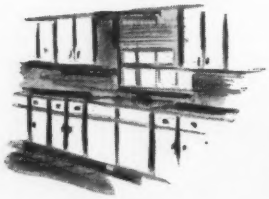


TRAILER BODIES

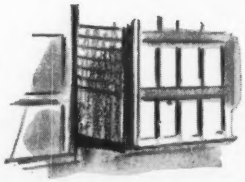
PLAYTHINGS



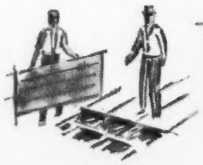
METAL AWNINGS



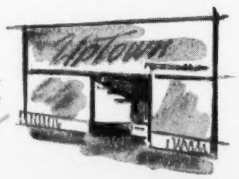
KITCHEN EQUIPMENT



BUILDING FACADES



FLOORING



STORE FRONTS

THE STEEL COMPANY OF CANADA, LIMITED

Executive Offices: Hamilton and Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Sudbury, Winnipeg, Edmonton, Calgary, Vancouver. J. C. Pratt & Co. Limited, St. John's, Newfoundland.

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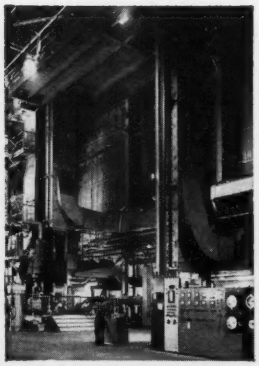
OND STEEL SHEETS

.TAKES PAINT and HOLDS IT!

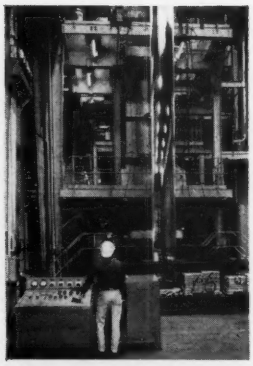
NO PRIMER . . . NO PREPARATION . . . "Colourbond" is a high quality galvanized steel sheet designed to meet the countless applications in manufacturing and construction, where strength . . . resistance to rust and corrosion . . . and lasting beauty in a painted finish are essential requirements.

Stelco's process gives "Colourbond" a surface of tightly bonded zinc-iron alloy, with the characteristic appearance of a "wiped" galvanized coating. This surface remains intact through working and forming, even up to the limits of the base steel itself. Its highly absorbent properties allow "Colourbond" to take paint readily without initial preparation or the application of primer coat for most end uses. A "tooth" on the zinc coating locks the paint to the sheet for a long-lived attractive finish.

For full information on "Colourbond", in sheets or coils, contact any Stelco Sales Office.



Galvanizing pot and cooling tower of Line No. 1

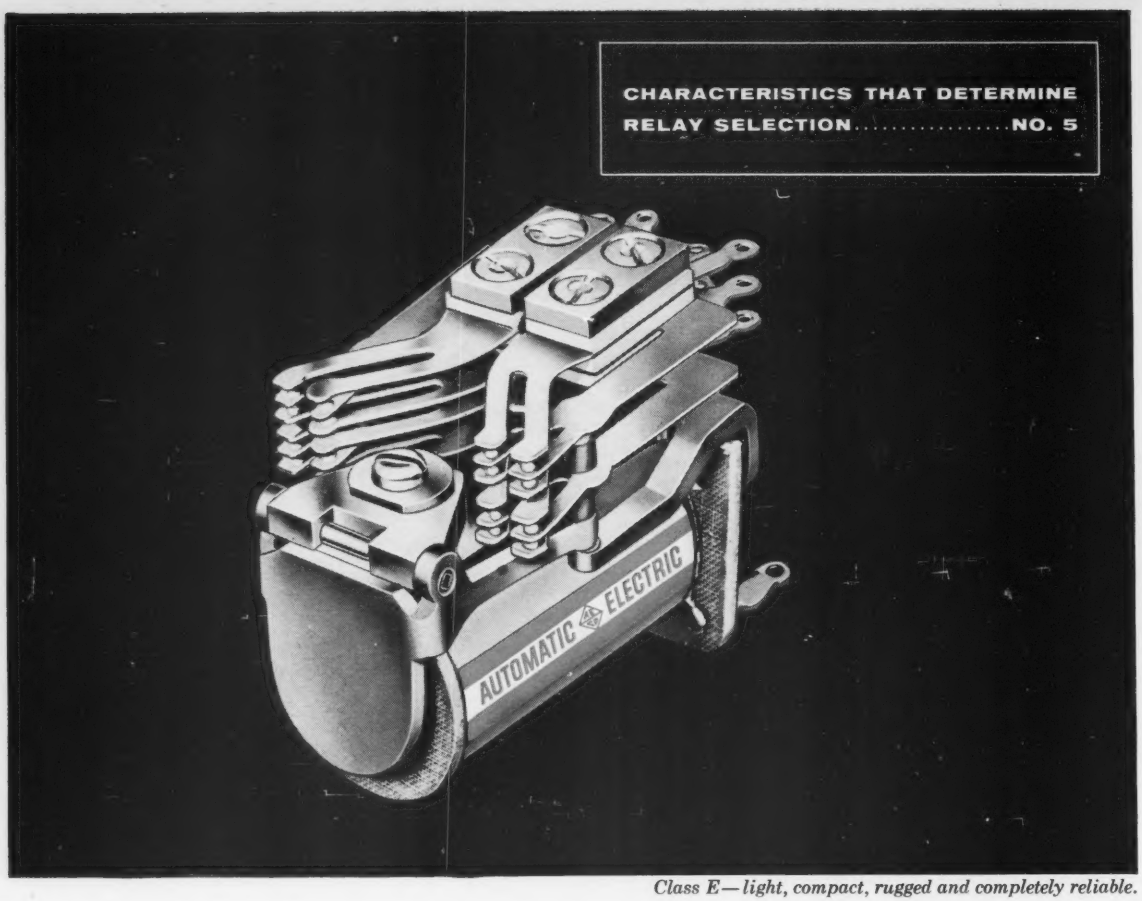


Zinc coated steel rising from the pot of Line No. 2

Stelco is now Canada's Most Versatile Producer of Galvanized Steel

With two completely separate and different galvanizing lines now in operation, Stelco's versatility in this field is unrivalled among domestic producers. The differing needs and preferences of all customers can be readily met from either of the production units illustrated here.

61111.B(2)



Class E—light, compact, rugged and completely reliable.

where telephone type features are required, with minimum size and weight

Helpful selection data
Class E Series

OPERATING VOLTAGE
Up to 220 volts d.c. or a.c.

CONTACTS
Twin, Code 0-18 ga. make or break 135 watts. Large, single contacts are available for heavy duty.

CONTACT CAPACITY
Maximum of 13 springs per pile-up.

COILS
Single wound up to 20,000 ohms. Multi-wound with up to three windings.

OPERATING TIME
Range, 0.002 to 0.050 sec.

RELEASE TIME
Range, 0.005 to 0.125 sec.

The Class E relay by Automatic Electric, is a miniaturized relay that provides the best of the telephone type relay features, with the least possible weight and space requirements. Its life is anything from 100 to 200 million operations, or more, and it has many features that are available for the first time anywhere in a relay of this size and shape.

Terminal spacing has been given particular attention for ease and speed of wiring, especially on the inside rows of terminals. The armature bearing and backstop design assure maximum dependability, and "sag-off" is prevented by the rugged construction of the armature arm, so that the original contact adjustment and reliability are maintained permanently.

The Class E is ideal for many small size computer applications, and can be used for a variety of purposes where light weight is particularly important. If you would like further information, call or write Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto, Ontario. Branches across Canada.

AUTOMATIC ELECTRIC

Subsidiary of

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

AN ORGANIZATION SERVING CANADIAN INDUSTRIES WITH COMMUNICATION AND CONTROL SYSTEMS

6046

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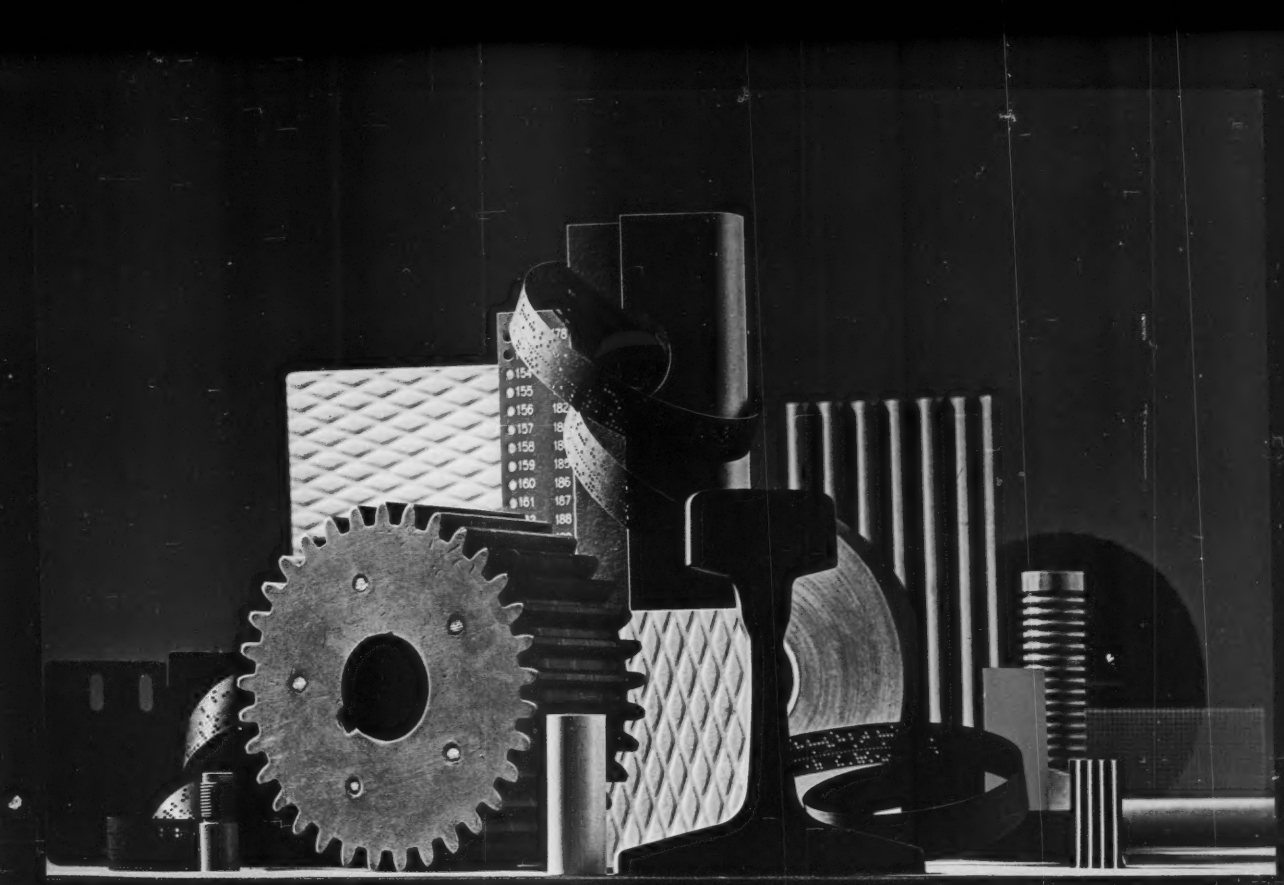


THIS remarkable plastic may trigger a new (or cost-saving) design idea for you

National Vulcanized Fibre is unique. It's a tough, cellulosic plastic—not mere paper or fibreboard. Vulcanized Fibre possesses an unusual combination of mechanical, electrical and thermal properties. For example . . .

It weighs one-half as much as aluminium, yet is one of the strongest materials known per unit of weight. It's tough, durable and cushions the shock of repeated blows.

Vulcanized Fibre has superior arc-resistance. It comes in standard and special grades, including a fire-resistant grade called "Pyronil." It can be machined, formed or deep-drawn into intricate shapes, and can be combined with other materials . . . aluminium, rubber, "Mylar," copper, laminated plastic, plywood, to name a few.

You can polish it, paint it, lacquer it, emboss it. And regardless of the finish, it resists oils, gasoline, fungi, most solvents. Most surprising is its low cost.

Send for more information, or write on your company letterhead to Dept. P for a free kit of samples today.

Find out for yourself why Vulcanized Fibre is "the plastic with a million uses."

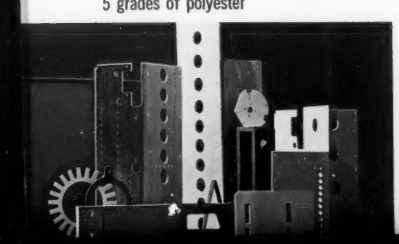
116 Choices: One Source This is the latest count of the different plastics and grades NATIONAL can offer in your search for the *one best material*. Add to this total, *the* one special grade that can be developed from scratch to meet your particular need. This full range of materials is backed by complete engineering services . . . from application assistance up to and including the delivery of Canadian-made, 100% usable, precision-fabricated parts . . . in any quantity, on time!

Contact the NATIONAL Sales Office near you. It's a direct line to single-source help on your current materials problem. Let us hear from you.

NVF

NATIONAL FIBRE CO. OF CANADA, LTD.
Atlantic & Hanna Aves., Toronto • 1405 Bishop St., Montreal

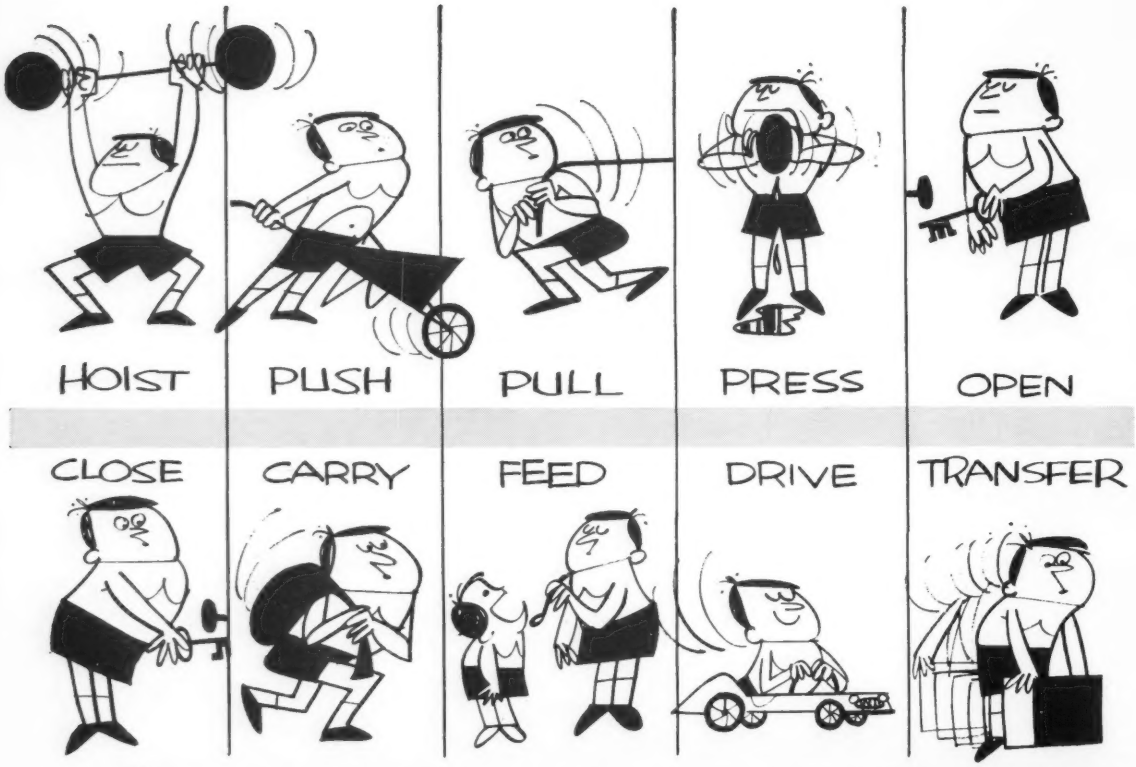
5 grades of polyester



85 Phenolite® laminates

3 thermoplastics . . . nylon, Delrin®, Penton®

Pick a problem! WESTINGHOUSE solves it



with "PACKAGED" AIR-OPERATED CONTROLS

Use compressed air directed by simple control equipment . . . air to work your machines . . . components or packaged systems for your pneumatic or hydraulic applications. Whether your interest is industry, marine and transportation, grain elevators or mining, Westinghouse offers components, knowhow and completely packaged units.

Each unit is factory tested with compatible components. Each does a job efficiently and economically. For complete dependability specify Canadian Westinghouse air and hydraulic cylinders, proportional pressure valves, "on-off" valves, positioning cylinders, compressors and completely packaged pneumatic systems.

For information contact the Air Brake Division, Hamilton, Ontario or phone Westinghouse representatives:

TORONTO — Rousseau Controls Ltd.,
2149 Yonge St., Tel. HU. 3-2776

MONTREAL—Rousseau Controls Ltd.,
640 de Courcelle St., Tel. WE. 7-3521

YOU CAN BE SURE... IF IT'S Westinghouse

CANADIAN WESTINGHOUSE COMPANY LIMITED

61A900

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announcement

Rousseau Controls Limited is pleased to announce the immediate appointment of the Company as exclusive distributor for the complete line of pneumatic components of the Air Brake Division, Canadian Westinghouse Company Limited.

Rousseau is Canada's fastest growing supply centre for everything in pneumatic and hydraulic components and basic systems. Look to Rousseau, too, for design, engineering, manufacture, installation, maintenance, overhaul and repair of industrial hydraulic and pneumatic equipment.

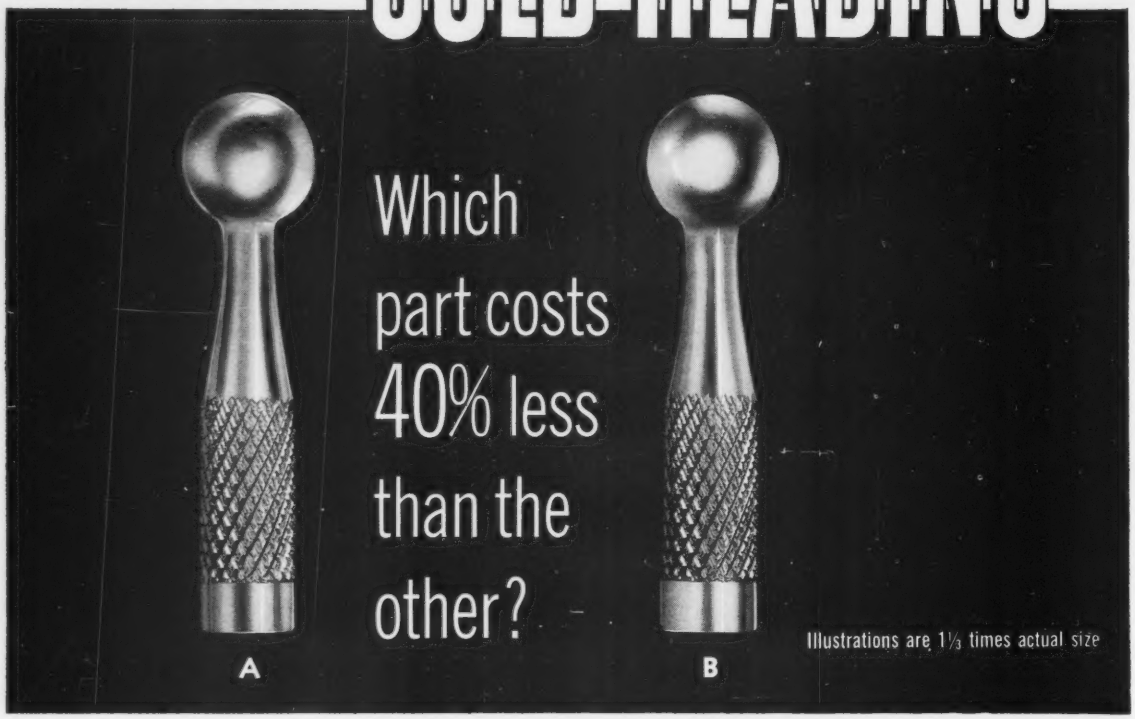
Watch for further news of Rousseau's dynamic development.

ROUSSEAU CONTROLS LTD.

640 De Courcelle St., Montreal 30, P.Q. WE. 7-3521
2149 Yonge St., Toronto 7, Ont. HU. 3-2766

For further information mark No. 147 on Readers' Service Card

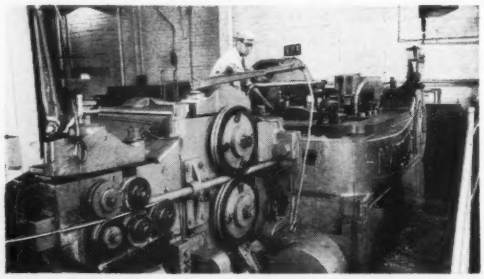
STELCO COLD HEADING



...and will last longer!

These "look-alikes" serve the same purpose, as components of a consumer appliance, but cost and service records quickly separate them.

Part A is Cold Headed (with secondary operations) by Stelco. It costs approximately 40% less than B, the machined part it replaced and, because it is stronger and more durable, will function longer.



COLD HEADING MACHINE FORMING CONTOURED PARTS FROM WIRE

Cold Heading economizes by eliminating material scrap and speeding production runs. The process also increases tensile strength and adds toughness to the material, giving greater durability to the finished part. Flattening, bending, punching, drilling, threading and other operations can be added to widen the design range.

COLD HEADING is a precision forging technique. Steel, or any forgeable metal, up to 1" diameter can be upset to at least 4½ times its original diameter to form contoured parts. Production rates are high and the saving in material often reaches 60% and over.

CONSULT STELCO'S ENGINEERING SERVICE. Perhaps Cold Heading can introduce a saving for you. For further information contact any Stelco Sales Office.

STELCO THE MARK OF QUALITY

THE STEEL COMPANY OF CANADA, LIMITED

Executive Offices: Hamilton and Montreal

Sales Offices: Halifax, Saint John, Montreal, Ottawa, Toronto, Hamilton, London, Windsor, Sudbury, Winnipeg, Edmonton, Calgary, Vancouver. J. C. Pratt & Co. Limited, St. John's, Newfoundland.

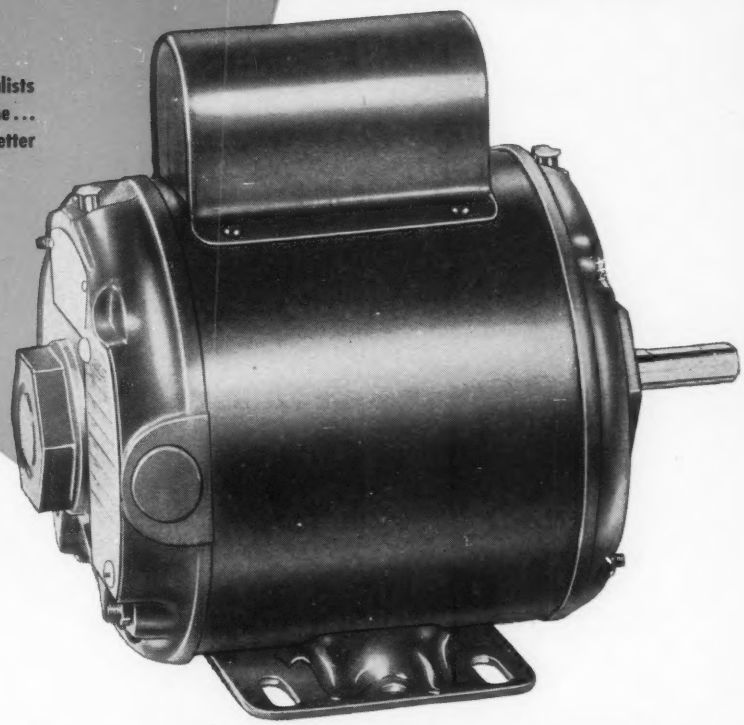
60171.B

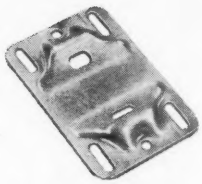
For further information mark No. 151 on Reader Service Card

RUGGED*...

the dependable Wagner single phase electric motors in the smaller, more compact 48 frame

*Wagner engineers are specialists in one field and one field alone... making motors to perform better and last longer.





The ingeniously designed base, lightweight but extremely rigid, prevents distortion.

Non-warping cast iron end bells add stability—ruggedness.

Here was the problem—to build a single phase electric motor that was tougher, more solid, with extreme ruggedness—yet it had to be LIGHTER AND MORE COMPACT! The answer? Wagner's tough little single phase motors in the new 48 frame.

And they are amazingly efficient too! They're cool running—40° C rise with full service factor. Most efficient lubrication of sleeve bearings with advanced "Permawick" lubricating system. The switch has silver contacts and stainless steel spring.

The cast iron end bells have been specially designed to eliminate any possibility of warping.

And, for your convenience, all these Wagner motors in 48 frames (except those with only 2 leads) have permanently attached wiring diagram etched on metal. You can't lose it.

Next time you order an electric motor, buy the motor built by motor experts—specify Wagner.

1032

Wagner Motors are designed, engineered and manufactured in Canada

Wagner ELECTRIC
(DIVISION OF SANGAMO CO. LTD.)

HEAD OFFICE: LEASIDE, TORONTO 17, ONT.
PLANTS: LEASIDE, ONT., TROIS RIVIÈRES, P.Q.
SALES OFFICES: TORONTO, MONTREAL, WINNIPEG, EDMONTON

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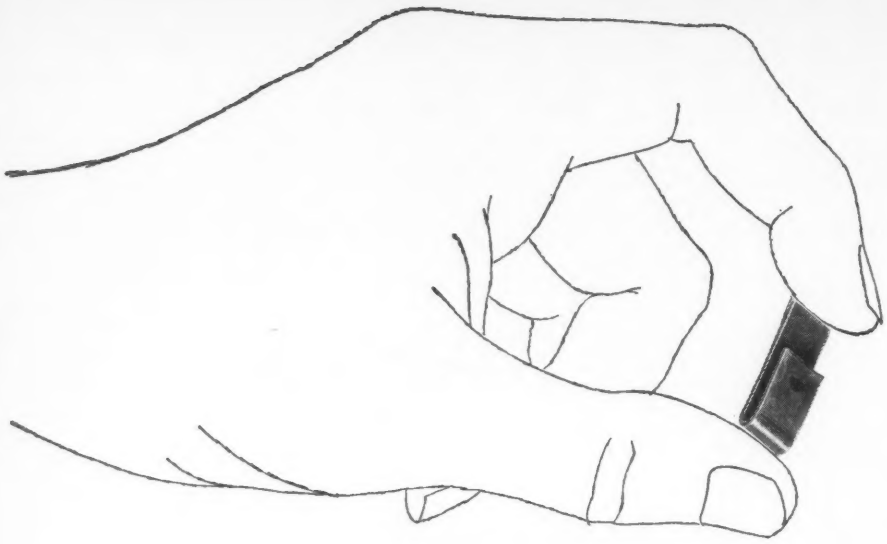


IMPORTANCE COMES IN MANY SIZES

This stamping is one of thousands developed and manufactured by the engineering team of Wallace Barnes. Although it is small, it has an important part to play in the end product. It must be exactly right in design, temper, and performance characteristics to function positively and reliably in the product in which it is used.

To be sure *your* stampings are exactly right, get the benefit of Wallace Barnes' 500 man-years of experience in the specialized field of small stampings and springs.

Modern tool-making and production facilities are your assurance that each and every stamping will meet your specifications.

From creative engineering to prompt delivery . . . you can depend on Wallace Barnes.

Send for your FREE copy of "Pocket Guide to Springs and Other Things". A pictorial guide of our products and services.

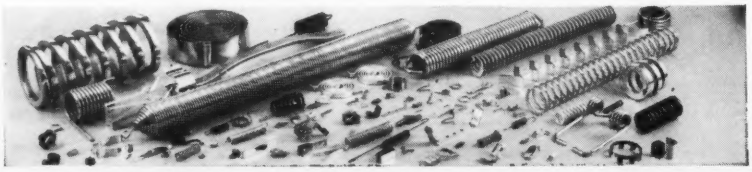
The Wallace Barnes Company Ltd.

Associated Spring Corporation

Hamilton, Ontario

Pointe Claire, Que.

Sales Agent: E. A. Tipping Sales Ltd., Winnipeg—Vancouver (Richmond)



64-230

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There's no end of possibilities with

STEEL TUBING
by STANDARD TUBE

STANDARD TUBE
STANDS FOR
ALUMINUM TOO!
Sheet, Bar, Extrusions,
Tube and Wire—avail-
able in any quantity.

STANDARD TUBE AND T.I. LIMITED

WOODSTOCK - HAMILTON - TORONTO - OTTAWA - MONTREAL - VANCOUVER

AGENTS IN OTHER PRINCIPAL CITIES

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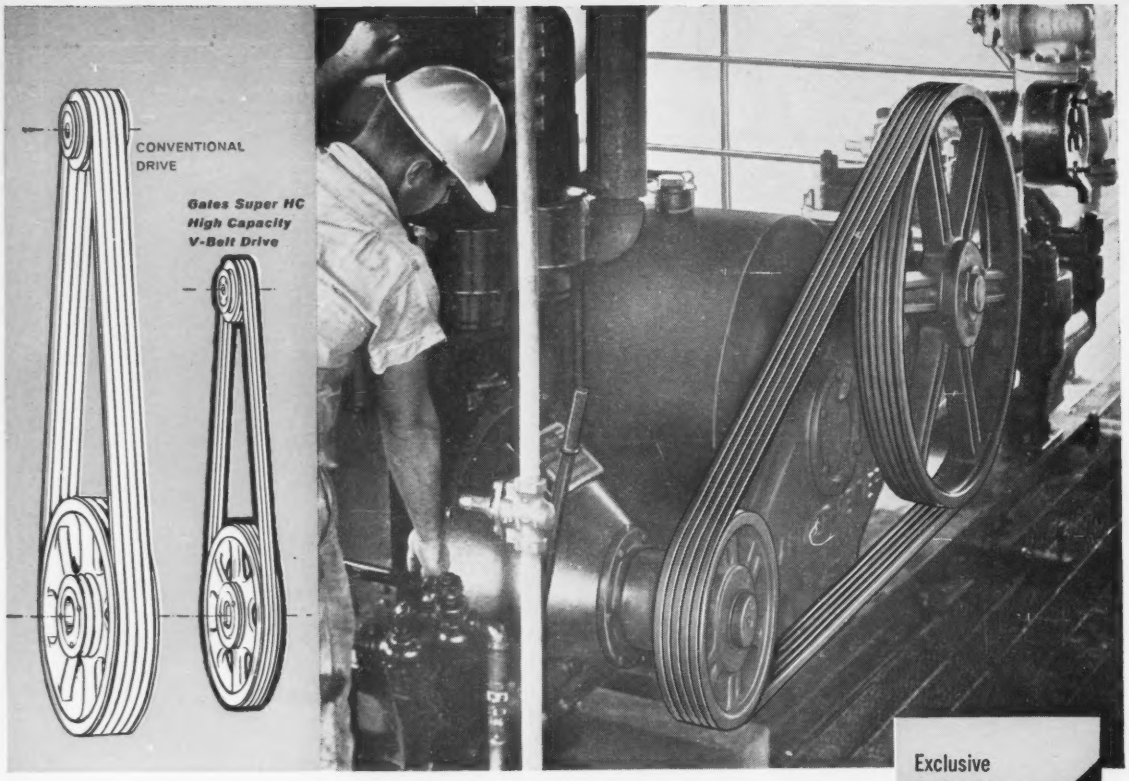


Gates High Capacity V-Belt Drive handles greater power in less space!

Gates Super HC V-Belt Drives, in use throughout Canada on all types of machines, are meeting the industry-wide demand for a means of transmitting greater power in less space.

Because of exclusive design features, Gates Super HC High Capacity V-Belts handle up to 3 times more horsepower than conventional V-belts in the same space. Or the same power can be handled with fewer belts and smaller sheaves, saving up to 50% in drive space and cutting drive costs as much as 20%.

Further, with smaller, lighter sheaves, bearing loads are reduced. Guards, machine housing, countershafts, etc., can be smaller. Shipping weight is less.

The drive can operate at belt speeds up to 6,000 ft/min without dynamic balancing. This permits use of higher rpm motors, with savings in motor costs.

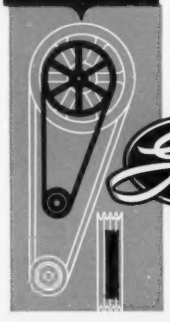
Industrial plants throughout Canada have standardized upon Gates Super HC V-Belt Drive, the 1st and most advanced high capacity drive. It is your best assurance that your power transmission units will not soon become obsolete.

Your local Gates Representative is an experienced, fully-qualified drive design expert. Contact him for drive design help.

Exclusive design features include:

precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

Gates Super HC Drive saves space, weight and money



Gates

Building the future on 50 years of progress.

Gates Rubber of Canada Ltd., Brantford, Ontario X959E

Gates Super HC V-Belt Drives

For further information mark No. 128 on Readers' Service Card

On your desk  in the morning

And, right away, you can be taking your first steps toward lower assembly costs. With your sample SPEED NUT fasteners you can experiment on your own product right on the line. And, like hundreds of manufacturers before you, you'll see the substantial savings you can make with the SPEED NUT method of spring tension fastening. You'll be amazed how easy they are to apply and the number of assembly operations you can eliminate. It's actually costing you money every day you postpone investigating SPEED NUTS.

Phone us collect and tell us about the particular attachment you have in mind. We'll do the rest. Naturally, we would like to send you samples of the more than 9,000 SPEED NUTS there are in existence . . . but obviously that's impossible. However, we'll select the ones that we know will do your job *better* . . . and at lower cost. Your sample fasteners will be on the way to you immediately.

Don't put it off. SPEED NUT brand fasteners have actually saved some manufacturers up to 75% over other methods. They can improve your profit picture too. Let us send *your* sample SPEED NUT and SPEED CLIP fasteners tonight.

Call Toronto, EM 6-1042—Montreal, HU 4-5567
Hamilton, LI 9-4661 *or write to*

DOMINION FASTENERS LIMITED
HAMILTON, ONTARIO—Sales Branches: Toronto, Montreal
a Geo. A. Tinnerman *corporation*

DOMINION FASTENERS
Exclusive TINNERMAN Canadian Licencee
Speed Nuts®

33-615

For further information mark No. 119 on Readers' Service Card

NEW WAYS *to use...*

HEIM *Unibal*® BALL BEARINGS

A significant contribution to bearing technology was made by HEIM when they first presented their exclusive and patented revolutionary concept in the design and method of manufacturing ball bearings.

These new bearings have solid, unbroken, machined inner and outer raceways; deep, burnished ball grooves; and a full complement of balls. There are no retainers, and the balls travel in races uninterrupted by counterbored rings or filling slots.

Ball Bearings for Special Purposes

With the Heim advanced techniques in ball bearing construction, additional features can be incorporated in the production of these bearings to allow wider applications not before thought possible.

For example . . .

"Sawsmith," made by Magna American Corporation, is claimed to be the world's finest Radial Arm Saw. It has four Heim Ball Bearings, specially designed with grooved outer members, which serve as glide bearings against the arm guide rails. These are mounted on an eccentric shaft for easy adjustment.

The Heim method presents the design engineer with virtually unlimited possibilities, such as . . . compact ball bearings with grooved outer members, single or double row types, plain or flanged outer members, and made for round, square or hexagonal shafts.

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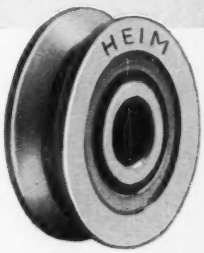

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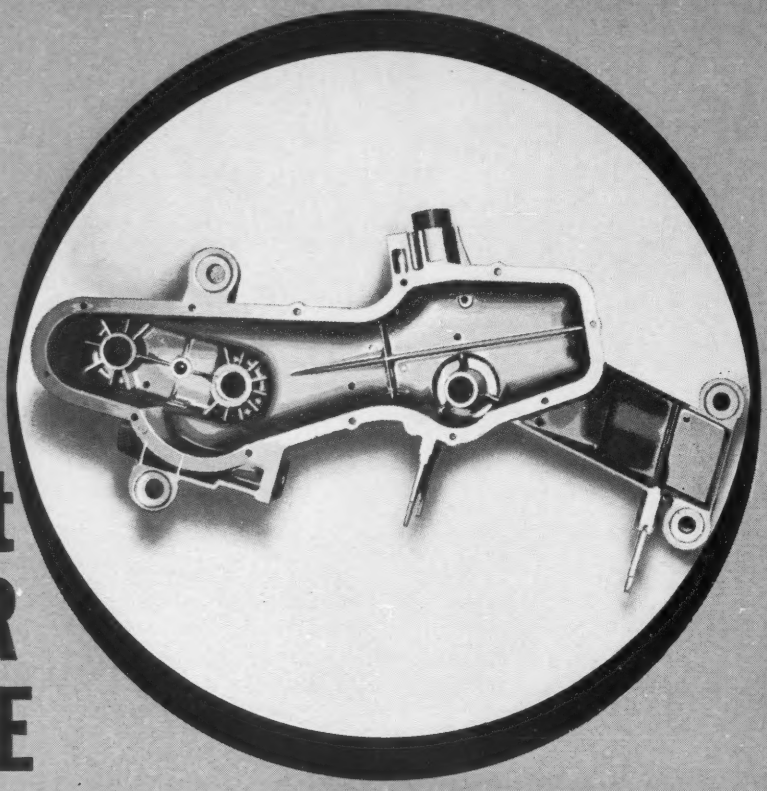

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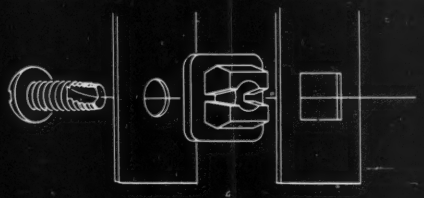

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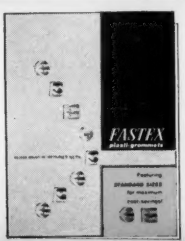

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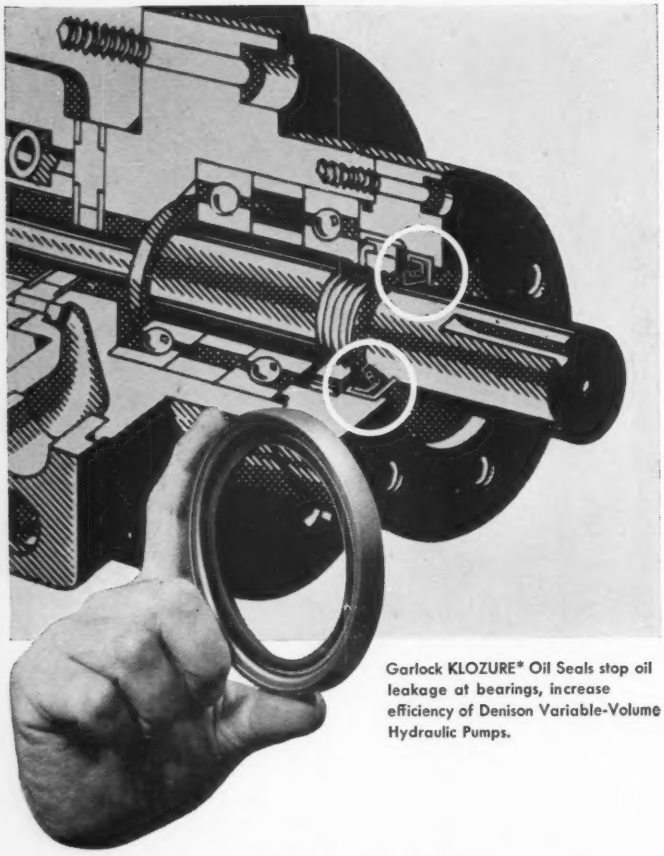

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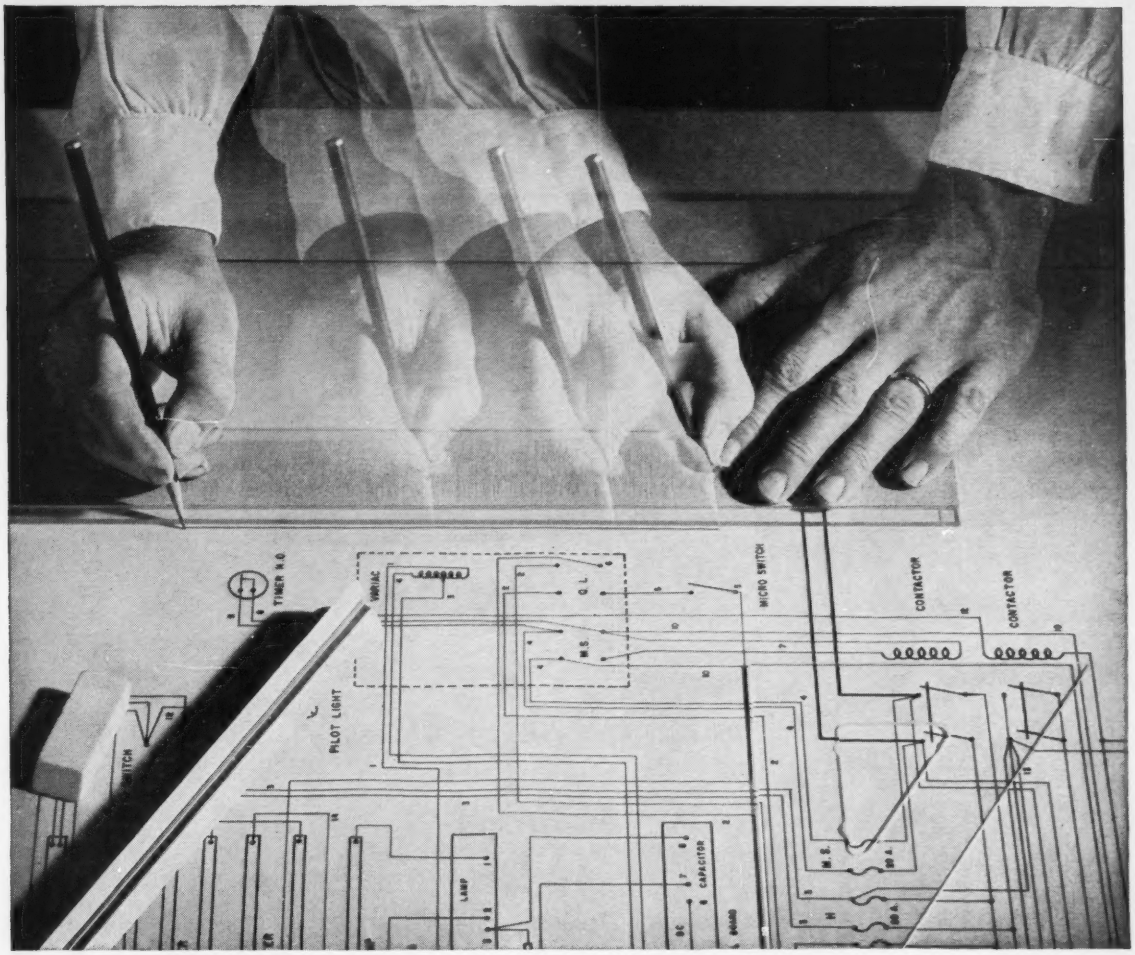

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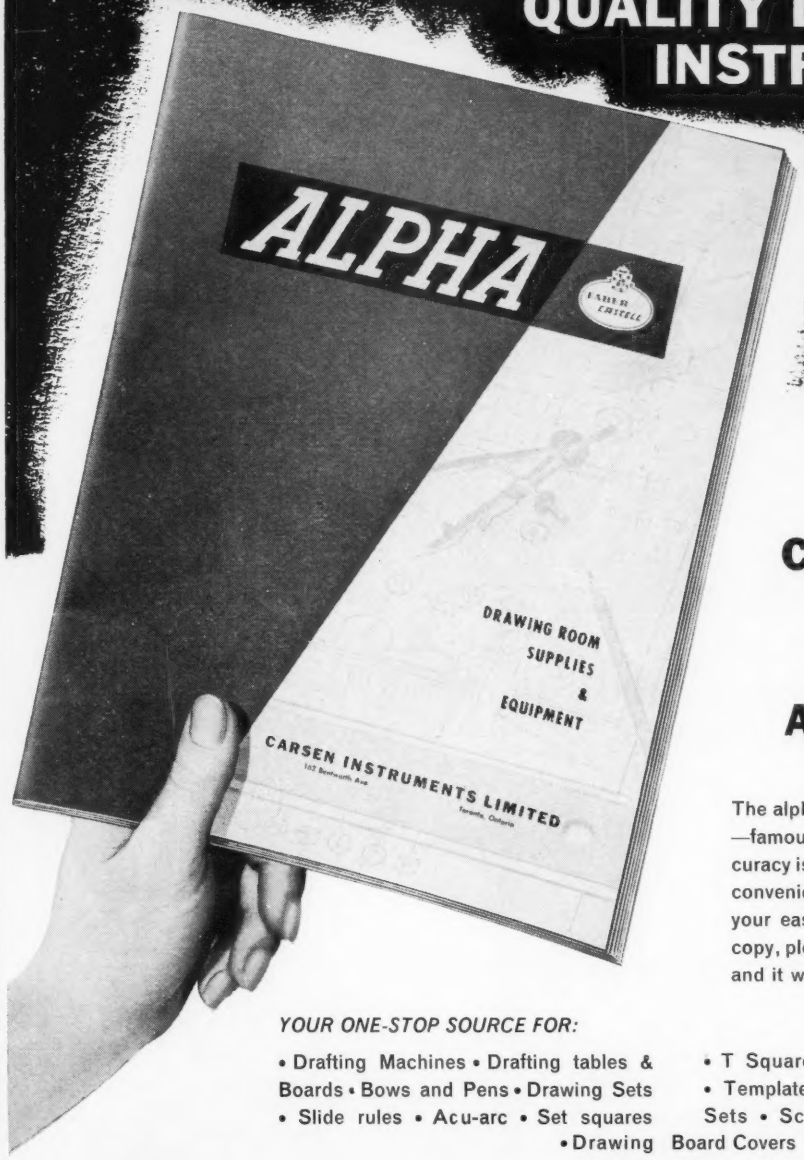

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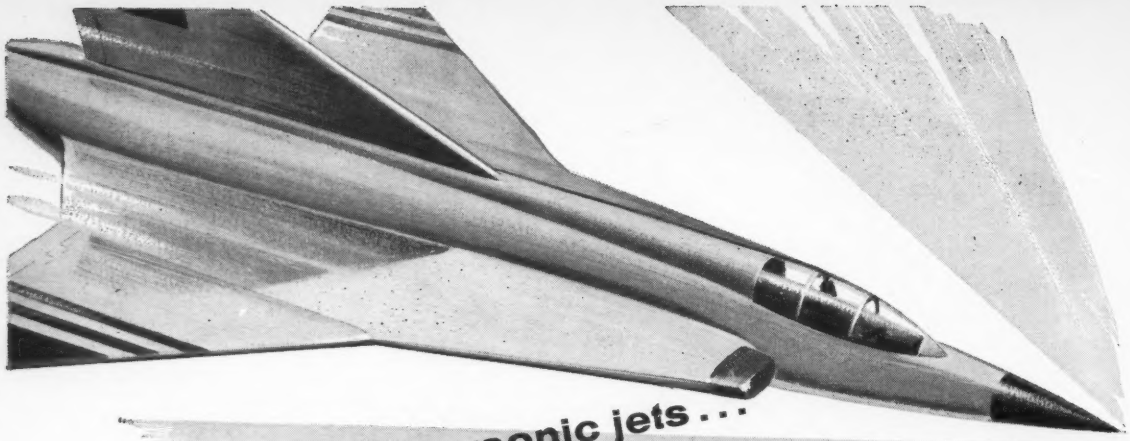

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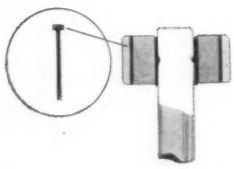
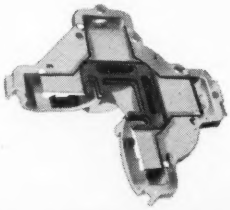


Adhesive bonding small pinion gears to rotor shafts provided savings of $56.37 per thousand by reducing rejects, and eliminating secondary operations and the necessity for 100% inspection.

A pump manufacturer reduced rejection rates from a high of 25% to nearly zero by adhesive bonding three separate die castings to form a single part.



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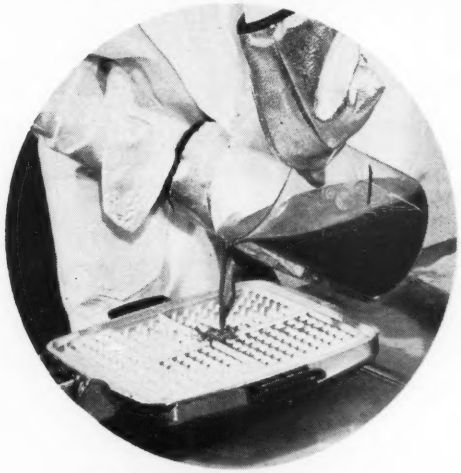
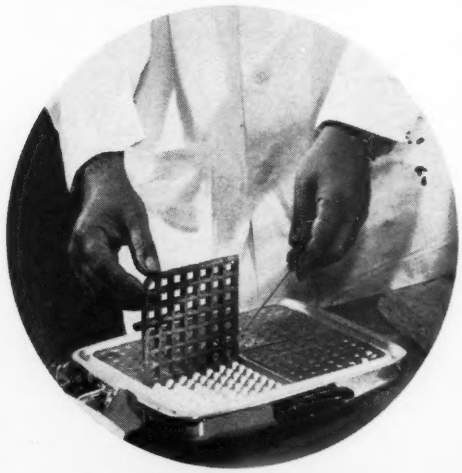
Catalyst is added to liquid monomer to demonstrate new casting process.



Hot, free-flowing liquid soon fills cavities of an ordinary waffle iron.



Polymerization, a little shrinkage and a nylon waffle — monomer cast.

Monomer cast nylon cracks the size barrier

Nylon has reached design maturity with a new process comparable in cost and technique to metal casting

A recent technological breakthrough in nylon processing has made possible the economical production of large, complex shapes and contours. By permitting the direct conversion of monomeric raw material to finished nylon at atmospheric pressure, engineers have been provided with a new material for designing large bushings, cams, rollers and contour wear parts such as tooling dies, liners and guide blocks. It should open new markets for nylon in heavy industry now using cast metal parts, since the conversion process is similar in techniques and costs to conventional metal casting.

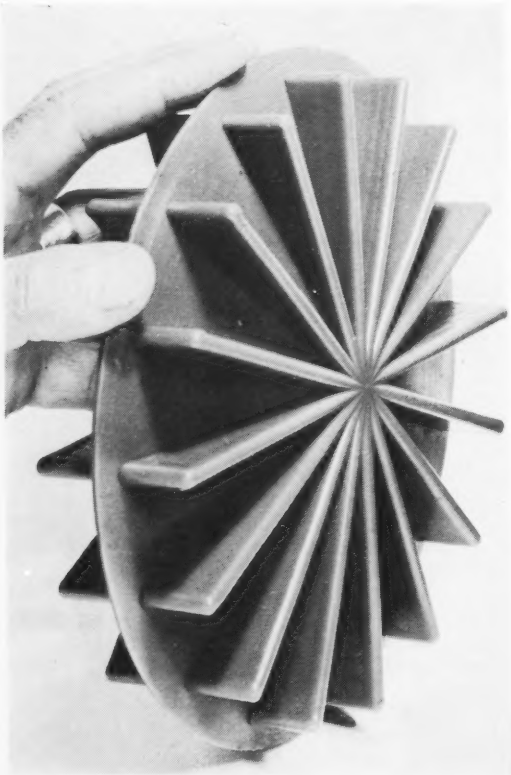
In announcing the development, Louis L. Stott, president of The Polymer Corporation, Reading Pennsylvania, said: "Until now, the inherent advantages of nylon have been unavailable in large parts because of the high tooling costs and the processing limitations of conventional molding methods. In monomer casting, direct production of the finished nylon parts from monomer rather than powders of nylon polymer cuts raw material costs in half." The need for expensive molds required in conventional injection or extrusion molding of nylon polymers is eliminated, since the new process can be performed at atmospheric pressure.

Competes with metals

Castings made from MC (monomer cast) nylon, which now cost between $3.00 and $5.00 per pound, are substantially lower in cost on a per piece basis than stainless steel or brass castings and compete favorably with alloy steels. In the next several years, it is expected that increasing volume and production economies could reduce the costs to about 50% of the present level, bringing MC nylon to a competitive level with carbon steel and aluminum castings.

The largest monomer cast MC nylon parts produced to date have been semi-finished symmetrical shapes in the 500 to 700 pound range. A steel casting the same

Monomer cast gear, 4½ feet in diameter is one of the largest ever manufactured in plastic.



Light-weight monomer cast impellers are suitable for handling abrasive materials.

size would weigh over two tons. "Theoretically, there is no technical limitation to the size part that can be made by the process," Stott explained, "however, markets must be developed for these newly available large sections."

Physical properties

To date, several consistent types of MC nylon have been developed. The majority of laboratory and field evaluations, however, have been performed with MC nylon 901. Its properties have been thoroughly tested and proven in both laboratory and field evaluations. It is the first standard formulation to be available in rod, plate, and tubular bar, as well as complex castings.

MC nylon 901 is similar to Type 66 nylon and maintains these properties with excellent consistency. While higher impact and softer grades of MC nylon have been developed, the 901 formulation has been successfully field tested in numerous applications where the basic physical strength of Type 66 is indicated. Its resistance to creep is especially outstanding.

Owing to its unique processing, MC nylon is essentially free of internal stresses. Because of this quality, parts cast from MC nylon have less tendency to change dimension than injection molded components. Field tests show that heavy sections of MC nylon (1 in. or above) do not tend to crack during machining, indicating the absence of random brittleness.

Resistance to fatigue under stress and vibration is apparently an outstanding characteristic. Initial field tests have shown that the life of this material is from 2 to 10 times longer than Type 66 nylon under identical conditions.

Nylon parts have been used primarily because of their exceptional resistance to wear in contact with metals and other materials where lubrication is impractical, contaminating, or difficult to maintain. MC nylon 901 has proven to be comparable to Types 6 and 66 nylon in this property. A newly developed high impact type of MC, when subjected to sandblasting, showed a wear rate less than half of Type 6 and one-third of Type 66. Perhaps of even greater significance, this new material has an impact resistance superior to both Type 6 and 66 nylons.

Tests reveal that MC nylon 901 is unusual in its ability to retain rigidity and not soften at elevated temperatures. The material will maintain its original form in bearing and structural applications considerably better than other nylons—an important design consideration.

For and against

The possibility of making large nylon shapes using techniques similar to foundry practices and involving pattern and mold costs of the same order of magnitude naturally leads to a comparison of MC nylon and various cast metals on both a performance and economic basis. MC nylon should be seriously considered wherever these metals are presently used, and where the end use does not require any of the following properties of these metals:

- Temperature Resistance — MC nylon is limited to 250-300 deg. F on prolonged exposure.
- Elastic Modulus — MC nylon is considerably less rigid with a modulus of 300,000 psi.
- Resistance to strong acid — MC nylon fails quickly.
- Tensile Strength — Metals are 2 to 10 times stronger than MC nylon.

In other important design characteristics, MC nylon

	Injection molding	Extrusion molding	Extrusion	Centrifugal casting	MC monomer casting
Mold pressure requirements	20,000 psi	100 to 300 psi	100 to 3,000 psi	100 to 300 G's	atmospheric
Maximum part weight (approx. current limits)	5 to 7 lb.	300 lb.	Not applicable	200 to 400 lb.	unlimited
Maximum thickness	¾ to 1½ in.	3 to 4 in.	4 in.	2 in.	unlimited
Price per lb. Normal ranges July 1961	$1.50 to $3.50 depending on wt., thickness and quantity	$4 to $13 depending on intricacy and quantity	$3 to $5	$4 to $6	$3.00 to $5.00 currently; $1.25 to $2 ultimately
Production rate	50 to 300 lb. an hour	30 lb. an hour	30 to 40 lb. an hour	1 to 8-hour cycle per mold	800 lb. casting in 1 hour
Limitations	Unsuitable for large parts	Low production rate	Low production rate; symmetrical shapes only	Low production rate; symmetrical parts only	Uneconomical for small parts

Design parameters for different manufacturing processes using nylon moulding powders.

Property		Units	ASTM method	Type 66 nylon	Type 6 nylon	MC nylon 901
Mechanical						
Tensile strength	73°F	psi	D638	9,000-12,000	9,000-12,000	11,000-14,000
Elongation	73°F	%	D638	25-200	25-250	20-30
Tensile impact	73°F	ft.-lb/in.²		90-180	40-150	80-100
Shear strength	73°F	psi	D732	9,600	7,600-8,200	10,500-11,500
Modulus of elasticity	73°F	psi	D638	400,000	350,000	350,000
Stiffness	73°F	psi	D747	200,000-400,000	230-350,000	200,000-400,000
Hardness, rockwell	73°F		D785	R110-120	R111-R118	R-118
Deformation under load	122°F 2000 psi	%	D621	1.0-3.0	1.0-2.5	0.5-1.0
Thermal						
Heat distortion temp.	264 psi	°F	D648	200	130-175	400
	66 psi	°F	D648	360	345-365	425
Melting point		°F	D569	496 plus/minus 9	432 plus/minus 9	430 (gel temp.)
Coeff. of linear thermal expansion		in./in./°F	D696	5.5×10^{-5}	5.0×10^{-5}	5.0×10^{-5}
Flammability		in./min.	D635	self-extinguishing	self-extinguishing	self-extinguishing
Electrical						
Dielectric strength short-time		V/mil	D149	300-400	300-400	500-600
Dielectric constant	60 cycles		D150	4.1	5.0-14.0	3.7
	10^3 cycles		D150	4.0	4.9-10.1	3.7
	10^6 cycles		D150	3.4	4.0-4.7	3.1
Power factor	60 cycles		D150	0.014	.06-0.10	.02
	10^3 cycles		D150	0.02	.06-0.11	.02
	10^6 cycles		D150	0.04	.04-0.13	.02
Other						
Specific gravity			D792	1.14-1.15	1.12-1.15	1.16
Water absorption		%	D570	1.5	1.5-2.0	.9
Water absorption — saturation		%	D570	7-9	8-10	5.5-6.5

Properties of the different types of nylon as provided by tests.

is, broadly speaking, similar or better. Advantageous properties are:

Bearing characteristics and frictional qualities with or without lubrication.

Non-galling or scratching to mating surfaces.

Resistance to corrosion by alkali solvents and mild acids.

Resilience, sound dampening properties, resistance to peening, and ability to absorb shock and vibration, and ability to conform.

Light weight.

Good electrical insulating qualities.

The basic chemistry involved in monomer casting was discovered by the Monsanto Chemical Company. Numerous patent applications broadly covering the process have been filed by Monsanto and a number have been issued or allowed in the United States or abroad. The Polymer Corporation has acquired the exclusive right to use the process in the field of casting nylon shapes in the United States and many other countries, and has now developed the technology from laboratory scale to commercial production.

MC nylon is now commercially available in stock shapes such as tubular bar in lengths up to 4 feet and in plate up to 4 inches thick in 4 foot by 4 foot sections. Larger shapes are in limited production. ★

How should we train industrial designers?

Prof. G. N. Soulis, a member of the National Design Council, outlines a course in one of engineering's newest subjects

In the August issue we discussed the industrial designer — a profile of the man and his functions. We touched briefly on the subject of his education, a matter of concern in this day of technological advance. Let us explore this aspect further.

Since most education in industrial design is given by or has grown out of arts and crafts schools, the subject has only recently begun to be discussed in engineering circles and has little practical history. However, as our technologically oriented society continues to develop rapidly, the subject also is gaining rapidly in importance. This article will give some thought to its practical problems and offer a hypothesis which could be used by any school concerned with engineering science training.

There is a clamor to include a multitude of subjects in the curriculum of an undergraduate school of engineering science. It is felt that the student must have a knowledge of this or that subject to function in a professional capacity.

This approach can, and often does, lead to the philosophy that education in the engineering science field is largely a matter of "programing the human computer" with facts and then, by large doses of applied mathemathics, training this "computer" to assimilate these facts in a manner which will give it the ability to solve problems posed by a qualified group of questioners.

This is, admittedly, a simplified and somewhat facetious analysis of a type of engineering science training which has proved successful in creating graduates who are well known and well paid as problem solvers and are what most people visualize as engineers.

Historically, the field of applying science to the human situation has been much broader than this problem-solving procedure. The great creations of applied science rarely come into being, because somebody is trying to solve a mathematical problem. Instead, they develop because somebody sees the possibility of creating a new or better servant for man.

Usually it is after this mental leap from scientific fact to material conception that the process begins of mathematically or experimentally solving the problems. A historical study of the creation of everything from can-openers to computers will reveal this sequence.

In schools of engineering science, emphasis has been placed on the analytical approach and in industry the analytical positions are largely filled by engineering science graduates. The same cannot be said about those positions in the industrial hierarchy which are creative.

This whole problem should be of concern to every school of engineering science since by definition a graduate of such a school should be able to fulfill the creative function in industry. Instead, the industrial designer is taking over in over-all design concept.

Our basic plans

The following two basic plans, evolved for undergraduate training, could be used as a guide by anyone interested in teaching design as a branch of the standard engineering courses.

PLAN A: Engineering graduates in industry are usually associated directly or indirectly with design. They are often a vital part of the group which creates the product for which their particular industry exists. Plan A is an undergraduate course in mechanical engineering which could introduce into the regular work some principles and methods of design. This plan in no way would attempt to make designers out of engineers but would prepare them as graduates to understand the design process. From it the student could proceed to more specialized work either in industry or post-graduate study, which would qualify him as an industrial designer in certain industries.

While this plan is for an applied science school, it could be modified for other fields such as architecture, business administration and economics, where the graduates come in contact with industrial design.

PLAN B: This is an investigation of some of the aspects and development possibilities of an undergraduate course in the degree of applied science. It would not qualify the graduate as an engineer, but would form the groundwork for a graduate course in industrial design. It would also give sufficient training for the graduate, without any further formal study, to perform the function of industrial designer in certain limited fields.

The idea of seven years' study to qualify as a professional industrial designer may seem unattractive. But professional design at the technical industrial level requires as thorough a professional training as medicine, law or specialized engineering. The profession as such is suffering from too low a level of training and competence. Anything less than a full professional course would be a disservice to society and the student.

The engineering designer program

PLAN A: It is important that any plan which proposes to give an engineering student an understanding of the design process is not presented as an extra. This would only add another course to a curriculum already struggling against too many unrelated subjects.

Instead, the student should be made aware early of the design process as illustrated in Fig. 2, Means for Designing, and as his regular work develops, he should be shown how this fits into the design process. He then will realize that design is the link between a body of non-material facts and conditions such as the existence of markets, financial capacity, structural data and technical knowledge, and the physical embodiment of these facts and conditions into production facilities, manufactured products and structures, and sales facilities.

This plan is not so much an addition to a B.Sc. course as it is a suggested re-orientation of some present material. It will enable the student to orient his thinking so that as a professional engineer he can operate

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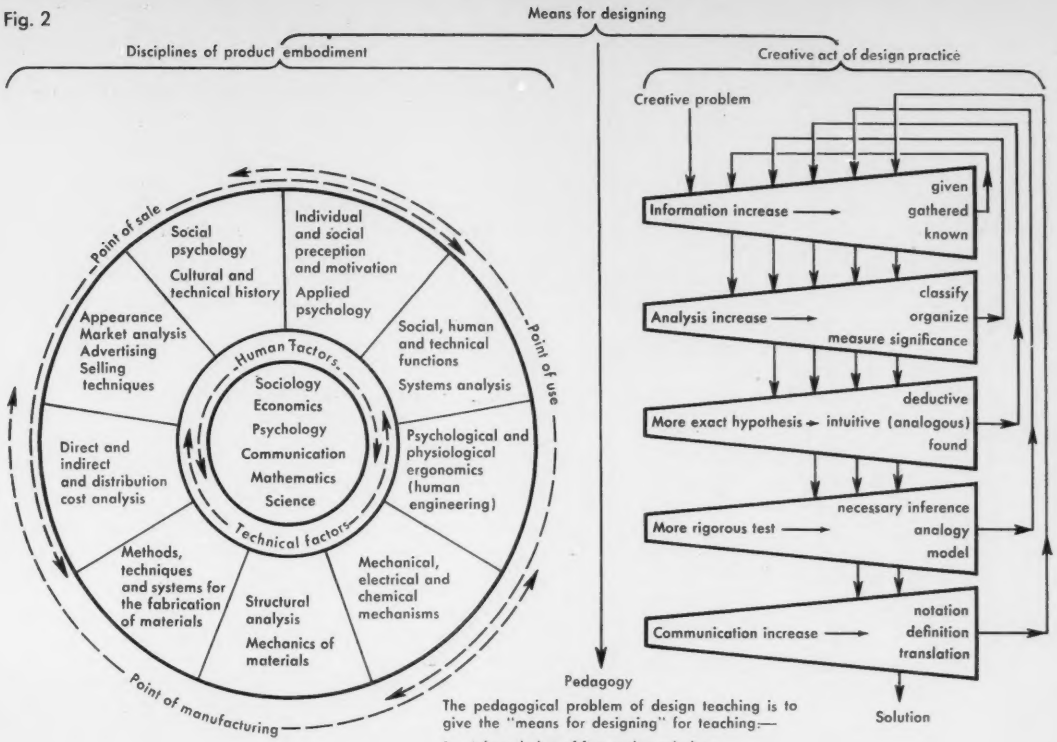
Fig. 2

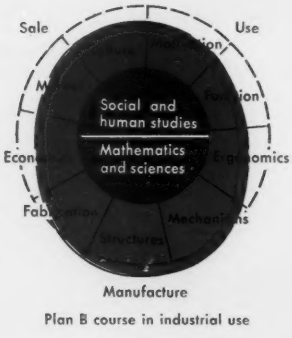


The pedagogical problem of design teaching is to give the "means for designing" for teaching:—

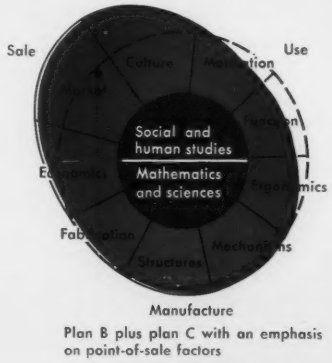
1 – A knowledge of fact and vocabulary
2 – A knowledge of methodology
3 – A dexterity and ability to discriminate through experience

Fig. 3

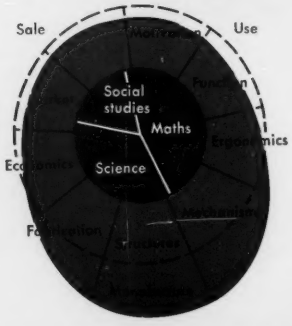
Present mechanical engineering course



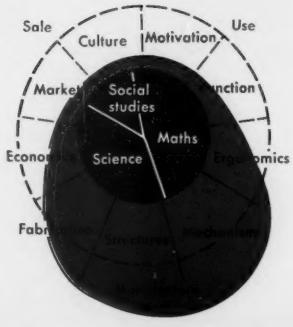
Plan B course in industrial use



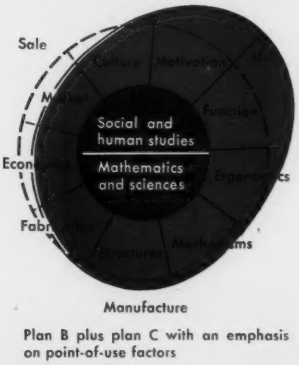
Plan B plus plan C with an emphasis on point-of-sale factors



Mechanical engineering course with plan A



Mechanical engineering course with plan A and C



Plan B plus plan C with an emphasis on point-of-use factors

Diagrams of course emphasis as planned by Professor Soulis.

creatively and establish a proper relationship with this link of design.

We shall begin by examining the present curriculum in mechanical engineering at the University of Waterloo to see how much of the Means for Designing is taught and whether this can be related to give the student an understanding of the total design process.

Fig. 3 includes a wheel chart showing the approximate emphasis of the present mechanical engineering course. The areas shown are about proportional to the time devoted to the various theoretical subjects and surrounding practical disciplines.

Part 2 of Fig. 3 shows a proposed chart of the curriculum if Plan A were adopted. At first glance this may appear as merely a case of evening out the graph to make it look good. However, this symmetry has a logical basis and changes proposed are only where the design factor already exists in the curriculum or where the curriculum already comes in contact with disciplines not connected with the technical aspects.

The changes come from a different emphasis in what is at present the main design course, called Machine Design I and II given in fourth and fifth years. The suggested changes are:

- A reorientation of the present English course to a course in Human Communications.
- Inclusion of a course called "History, Analysis and Criticism of the Industrial Product" as a non-technical elective.
- That the Machine Design course be primarily concerned with mechanical systems design and be so designated.
- That the Machine Design course begin with functional systems study, work through to the machine as part of the system and subsequently to machine elements as a part of the whole system, rather than beginning with the design of machine elements and working toward the machine as a whole.

There are three major reasons for the suggested changes in the Machine Design course:

1. The mechanical engineer's practice is usually more concerned with the design of systems than with individual elements. Most modern machines are part of an interacting system. Unless the designer is content to work within narrow constraints assigned by somebody else, he must be able to analyze the total system and from his analysis establish the constraints and working conditions inherent in his own particular section of the total problem. The actual problem of the design of a particular element then is usually relatively simple and is often merely a case of using the appropriate components from the right handbook or supplier's catalogue.

2. The suggested changes follow more closely the method used today. In the past, limitations on the mechanical, structural, or chemical mechanisms available to the engineer often became the governing factors in much design. However, the rapid growth in knowledge means that today the functional considerations usually govern the machine elements — the environment shapes and creates the machine.

3. Since this course, by definition, must not only teach the disciplines of design, but also give practice in the creative act, the arrangement suggested lends itself to a gradual development of creative ability. It fits the concept that the design process involves learning to ask as well as answer questions.

The general structure of the course is based on a series of exercises, carefully planned so each gives the student practice in the whole creative act with emphasis on one aspect. At the same time it utilizes his knowledge of familiar disciplines.

In the creative practice, the student should develop a dexterity in the analysis of given, gathered, and known information by means of classification, organization, measurement and testing for significance. He should have practice in building up deductive, intuitive and found hypotheses and testing them through analogy, necessary inference and model situations. As well, he should develop some degree of dexterity in the communication of his hypothesis by means of notation, definition and translation.

In the disciplinary practice, he should develop dexterity in applying his knowledge of properties of solids, mechanics of machinery, control systems, manufacturing analysis, applied mathematical analysis, engineering drawing and other subjects presented elsewhere in the curriculum. The lecture portions should give him some knowledge of fact about mechanisms, man-machine-work systems analysis; some of the fundamentals of the psychological and physiological aspects of ergonomics; visual acoustical and tactical aspects of display and control situations, and finally some of the vocabulary of scientific management in such fields as market analysis, statistics, finance and sales.

The industrial designer program

The undergraduate course in industrial design must be planned to fit within the national, industrial, consumer and pedagogical constraints. But they themselves are primarily intuitional and still open to more factual development. Therefore, the model for Plan B must be viewed as a rough hypothesis to be used as a basis of study and discussion.

We are also faced with questions concerning not only what should be taught but how it should be taught. The latter has been a subject of investigation for the past 35 years at most and has usually been concerned with the art-oriented aspects of design. While the method of industrial design teaching has much in common with teaching in general, it is a mistake to assume there are no special aspects or that teaching methods from schools of science or art can be successfully transferred to industrial design teaching.

The proposed curriculum has these characteristics:

- It could be a course offered in a Canadian engineering school.
- It would enable graduates to operate in many different social situations and to develop a philosophy not tied to a specific current theory or methodology.
- It is designed to fit into the middle horizontal area of design. It avoids overlapping the art-oriented horizontal level.
- It attempts to offer a balance between the technical and human factors of design.
- It offers opportunity for training in the creative art.
- The work is sufficiently demanding to justify degree status and should ensure the public of a sufficiently high standard of professional practice.

Cooperative work assignments

The co-operative work assignments of Plan B point up one reason why the University of Waterloo was chosen as the example of an engineering science school from which to build the plan.

The student's off-campus work is important to industrial design training. Therefore, the co-operative plan as used at Waterloo appears ideal for controlling the students' development. However, correctly placing the student may prove more difficult than in straight engineering. ★

At last: Ferguson's dream car

When he was in Canada, the late Harry Ferguson talked much of his revolutionary design for a super-safe family car

An automobile research team pulled back the covers on a pre-production prototype station wagon in Coventry, England, last month. There, for its first long-awaited public airing was a "super-safe" four-wheel drive car that was the dream of the controversial Irish-born tractor king, Harry Ferguson.

For several years now, fruitless promises have been made on the car's debut. And unfortunately it was not until a few months after his death (Ferguson died earlier this year) that the car bowed in.

Harry Ferguson was the man who, in 1935, revolutionized the tractor. His safe light-weight version with built-in plow was scoffed at by British farmers still very much attached to the horse. But his idea went over with Henry Ford who produced the tractor until their partnership ended in a spectacular legal battle. Ferguson will always be known as the man who dared sue Ford for a quarter of a billion dollars for conspiring to ruin his business and for infringement of patents. He won $9.25 million.

With a well-established business reaching out to other countries around the globe, Ferguson later joined forces with the Canadian firm of Massey-Harris to make his tractor for the North American market. But he sold his interests in the farm machinery business in 1954 and retired to England to realize his dream: a skid-proof, four-wheel drive car with super brakes.

High-performance motor

The present prototype is a 2.2 litre six-seater capable of 25 miles per gallon. It has a flat horizontally-opposed high-performance engine, mounted ahead of the front axle to allow extra space for passengers and luggage. Automatic hydraulic transmission, designed by Count Teramala, an Italian, gives a smooth flow of power throughout the speed range without jerks or tire wear. Owing to the minimization of moving parts in the transmission, developers claim repair bills will be slashed by 25%.

For the body design, Italian stylist Michelotti was called in. He came up with reduced bulk, little overhang and no sharp edges. The version pictured on this page has yet to be modified to conform with recent safety-stylings recommended by the British Road Safety Committee.

Smooths out the bumps

British motoring writers who tried the prototype on test runs applaud its comfortable ride which results from all-independent hydraulic - pneumatic suspension. Because the car has light-weight drive shafts connected to each wheel it has been possible to mount all four disc brakes on the chassis, reducing the unsprung weight.

There is also praise for its brakes. One writer said he could tramp hard on the pedal without losing control, and could even steer around an obstacle with brakes on. Its aircraft-type brakes will not lock and test drives have shown an emergency stop is possible in 149 feet on a wet road at speeds of 45 mph.

No price-tag has been fixed yet, and this is not likely until the developer, Harry Ferguson Research Limited, has finished negotiating with a number of British manufacturers to decide who will produce and market the model. Ex-racing driver, Tony Rolt, who heads the research team, says he's aiming at a Jaguar-class market. And the date in the showrooms: hopefully, 1963. ★

How to evaluate hydraulic deceleration

T. H. Beard, P.Eng., shows how to assess the three available methods for hydraulically decelerating a load

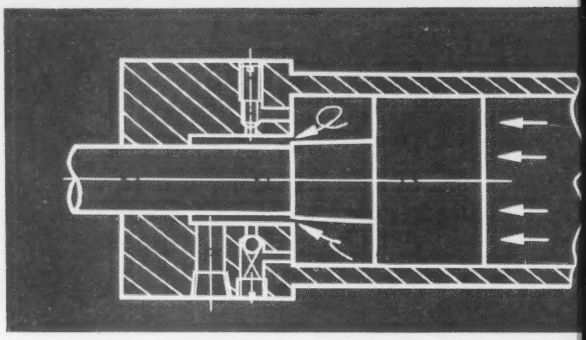


Figure 1

I well remember the first occasion on which I encountered this problem of deceleration. A long stroke hydraulic cylinder was to be used to pull a work head in a special purpose machine. The work head was a heavy slab of steel and was to move through a stroke of six feet in three seconds. This combination of heavy weight and high speed of movement posed the question of how to stop the monster. There seemed to be a number of alternative methods available but so little literature was at hand that it was difficult to justify one system more than another.

There are three well used devices for hydraulically decelerating a load, and all utilize the same principle—restricting the exit of exhaust oil. These three devices are:

- Cushions built into the cylinder.
- Decelerating valves.
- Snubbers applied externally to the load.

In most cases it is not necessary to resort to a theoretical approach in establishing the suitability of one method against the other. The first two devices, for instance, cover a large range of load conditions and, being adjustable, a little experimentation will yield the optimum result. However, there are cases where experimentation just won't do and we have to get down to some arithmetic.

Cushion most economical

The most economical deceleration device is the cylinder cushion. Cushions are standard features available on most hydraulic cylinders, and are accompanied by a cushion adjusting screw and built-in ball check valve. Figure 1 shows a cylinder with a cushion built into the rod end. The cushion plug is shown just entering the cushion hole and partly trapping the exhaust oil. This is the start of deceleration. Because the plug is tapered, the annular escape orifice reduces as cushioning proceeds. This results in a constant back pressure which produces a constant deceleration.

Each cylinder manufacturer has standardized on his own length and taper of cushion plug. Some have short cushions, some long ones. In every case, however, the cushion can only operate smoothly under one combination of velocity and mass being moved. Other combinations produce either a hard or soft cushion effect. The adjusting screw is provided to allow bleeding off some of the trapped oil should the cushion effect be too severe. This is a compromise only, as the ideal procedure would be to change the taper of the cushion plug. The chief fault of cylinder cushions is their short, fixed length which restricts the distance over which deceleration can be applied.

In spite of their limitations, however, cylinder cushions satisfy the majority of needs. After the stroke is completed and it is necessary to reverse the direction of movement, oil travelling from the inlet cylinder port to the piston is restricted by the cushion plunger. The inclusion of the ball check allows the oil to bypass this restriction and provide nearly full flow to the piston.

Checking back pressure

A cylinder cushion will do only so much and it is advisable to make a check on the maximum back pressure being built up. This is particularly necessary if the velocities of the piston and the mass being moved are high. For example, calculate maximum back pressure on 2″ bore cylinder when cushioning at the rod end. Length of cushion is ¾″. Diameter of cushion (approximately equal to diameter of rod) is 1″. Velocity of piston before cushioning is 1.5 fps. Load being moved horizontally is 24,000 lb. Assume we wish to reduce velocity to zero just before the piston hits the end cap. System pressure is 1,800 psi. A diagram de-

Nomenclature

A_1 = area of cylinder (sq in.)
A_2 = area of orifice (sq in.)
Q = flow rate (cu in./sec)
$\Delta P = P_1 - P_2$ = pressure difference (psi)
v_1 = ram velocity (ips)
w = specific weight of fluid (lb/cu in.)
C = discharge coefficient
g = acceleration of gravity (32.2 ft per sec^2 = 387 in. per sec^2)
S = distance (inches)

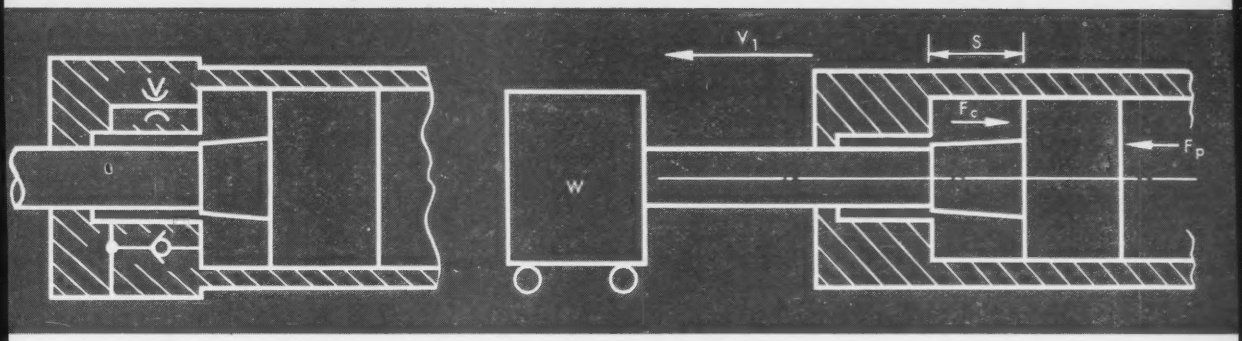


Figure 2

Figure 3

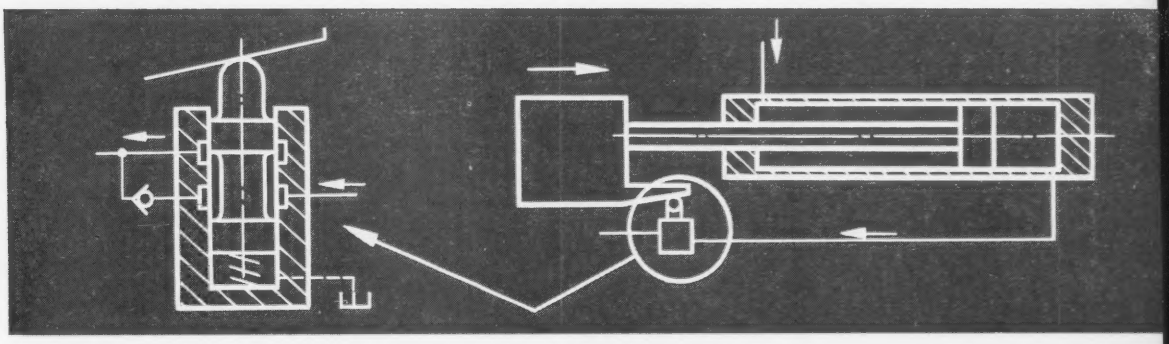


Figure 4

fining the factors involved is shown in Figure 3.

$$F_p - F_c = \frac{W}{g} \times a$$

$$(1{,}800 \times 3.14) - F_c = \frac{24{,}000}{32.2} \times a$$

Now, a is found from:

$$v_f^2 = v_1^2 + 2\,a\,S$$

$$0 = 1.5^2 + 2\,a\left(\frac{.75}{12}\right)$$

$$a = 12 \text{ ft/sec}^2$$

$$\therefore\ F_c = 5{,}650 + 8{,}950 = 14{,}600 \text{ lb}$$

Back pressure

$$= \frac{F_c}{\text{rod end piston area}} = \frac{14{,}600}{3.14 - .78} = 6{,}200 \text{ psi.}$$

This back pressure would be too high for the usual range of medium pressure cylinders so adjustments must be made in either cylinder size, velocity or load to reduce the back pressure. If this cannot be done, then longer cushions can be requested of the cylinder manufacturer or a deceleration valve or external snubber used.

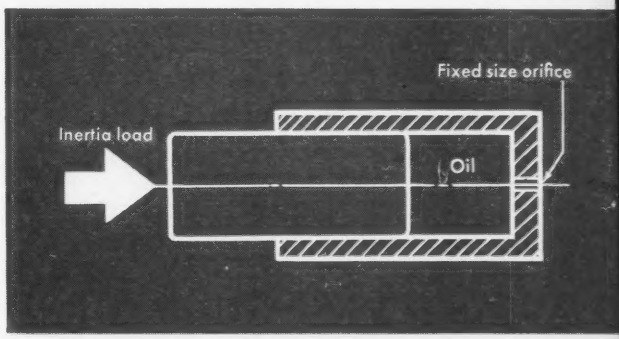


Figure 5

Deceleration valves

A deceleration valve works in a manner similar to a cylinder cushion by throttling the exhaust oil and creating back pressure. It is more flexible in that (1) the length of deceleration effect can be

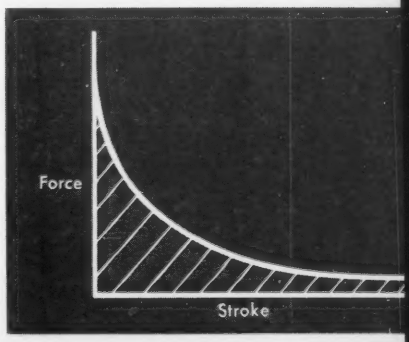


Figure 6

made as long or short as we wish, as determined by the length we make the cam (2) the pattern of deceleration can be experimented with, as this is controlled by the shape of the cam and (3) deceleration can be built into any part of the stroke of the cylinder.

In comparing the two devices so far described it is a case of "anything a cushion can do, a deceleration valve can do better." The main drawback to the valve, apart from its cost, is the fact that some cam mechanism must be included in the installation.

Snubbers are handy devices

An external snubber is a handy device that when used to control end of stroke deceleration overcomes the limitations of the former two methods. Snubbers are generally custom built and can be designed to fulfill all the requirements in decelerating a system. They are not restricted to slowing down a cylinder alone but can be used in non-hydraulic installations. They can be made extremely compact in size, are self contained and very reliable. They find their chief use in absorbing extremely high inertia loads, usually over very short lengths of stroke.

There is practically no limit to the ways in which a snubber can be designed but they all fall into two main types.

Type 1 — Constant orifice snubber

This uses the familiar dashpot principle. An inertial load applied to the ram is absorbed as the oil is forced out of the small orifice. While this is an economical piece of equipment to manufacture, it has a poor deceleration pattern, giving rise to a high shock load in the snubber at the very start of deceleration.

The shaded area in the graph of Figure 6 shows work done or energy absorbed, and because the resisting force varies through the stroke of the snubber, the deceleration is not constant or smooth. Extremely high stresses are built up in the snubber making sealing difficult.

Type 2 — Varying orifice snubber

Figure 7 represents the varying orifice snubber in principle although the manner in which the orifice is reduced as the ram moves through its stroke can be achieved in countless ways. One other method is to seal off a series of small holes as the ram completes its stroke. In order to provide a constant back pressure, and therefore a uniform deceleration, the taper on the plug is slightly curved and its dimensions calculated for, say, six different parts of its length. However, for all practical purposes a straight taper is good enough. We need only concern ourselves with the size of the annular orifice produced by the cushion hole and the plug at the small end. The diameter of the plug at the large end can usually be made as snug a fit in the cushion hole as manufacturing tolerances permit.

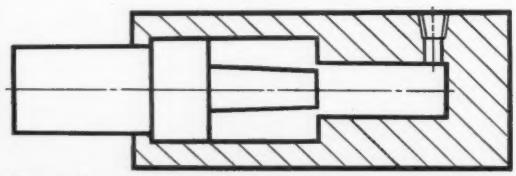


Figure 7

Because literature is scant on this subject, particularly at the practical level, and because examples are worth their weight in gold, a few situations involving snubbers are discussed now.

General principle of orifice flow

The general picture is shown by Figure 8. When oil under pressure is flowing through an orifice the

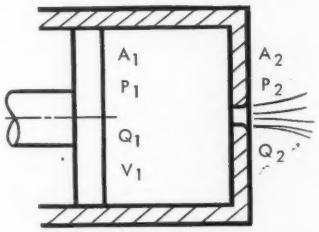


Figure 8

different parameters involved can be related as follows:

$$Q_1 = Q_2 = CA_2\sqrt{\frac{2g \cdot \Delta P}{w}}.$$

The discharge coefficient C is a function of Reynold's number and other factors, and for oil flowing through a sharp edged orifice can be taken as 0.65. This expression can be tidied up using $C = 0.65$, $w = 0.038$, $P_2 = 0$.

From this substitution we get

$$Q = 93A_2\sqrt{P_1}$$

and

$$v_1 = 93\frac{A_2}{A_1}\sqrt{P_1}$$

Example 1

An elevator is to have its speed of descent controlled by the exhaust oil metering through an orifice. What is the orifice diameter if the total weight falling is 28 tons and descent is to be 12 ips? Maximum system pressure is to be 2,000 psi. Ram diameter is 6 inches.

Solution:

$$v_1 = 93\frac{A_2}{A_1}\sqrt{P_1}$$

$$12 = \frac{93A_2}{28.3}\sqrt{2000}$$

$A_2 = 0.0815$ sq in.

Diameter of orifice $= 0.321$ in.

Figure 9

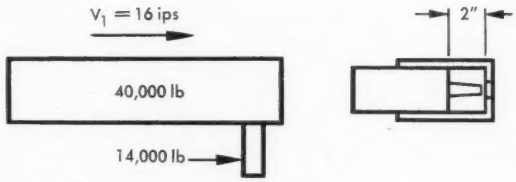


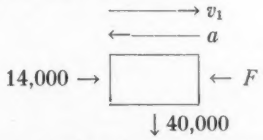
Figure 10

Example 2

A planer table with a combined load of 40,000 lb moving at 16 ips must be stopped by an external snubber. The machine is mechanically driven by a constant force of 14,000 lb and the table is to be brought to rest over a length of 2 inches. If snubbing pressure is to be not over 3,000 psi, determine the snubber cylinder diameter and dimensions of cushion plug and annular orifice.

Solution:

(1) Draw schematic diagram.



Note that deceleration equals acceleration in opposite direction.

(2) Equate and solve for F.

$$14{,}000 - F = \frac{W}{g}a$$

$$14{,}000 - F = \frac{40{,}000}{32.2 \times 12} \cdot a$$

a is found from

$$v_f^2 = v_1^2 + 2a \cdot S$$
$$0 = 16^2 + (2a \times 2)$$
$$a = -64 \text{ ips}^2$$

$$\therefore F = 14{,}000 - \left[\frac{40{,}000\ (-64)}{32.2 \times 12}\right]$$

$$= 14{,}000 + 6{,}660 = 20{,}660 \text{ lb}$$

(3) Obtain snubber cylinder bore size by trial method. Using a 3″ diameter snubber cylinder (7.07 sq in. area) gives a pressure of

$$\frac{15{,}660}{7.07} = 2{,}930 \text{ psi}$$

(4) Compute orifice area.

$$v_1 = 93\frac{A_2}{A_1}\sqrt{P_1}$$

$$16 = \frac{93A_2}{7.07}\sqrt{2{,}930}$$

$$A_2 = 0.023 \text{ sq in.}$$

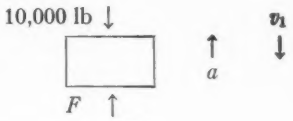
(5) Determine plug dimensions of snubber.

Selecting a diameter of .125 for the small end of the plug (.0123 sq in.), then the cushion hole needs to be .0123 + .023 = .035 sq in. area (.211 dia.). Thus a number 3 or 4 drill would be used for the cushion hole and the cushion plug would be 2 inches long with a small end ⅛ diameter and large end approximately 0.209 diameter.

Example 3

A body weighing 10,000 lb falls freely for 3 feet and must be decelerated in the next 6 inches. Calculate the orifice area if snubber pressure is to be around 1,500 psi.

(1) Schematic diagram of body at start of snubbing action.



(2) $10{,}000 - F = \frac{W}{g}a$

$$10{,}000 - F = \frac{10{,}000}{32.2 \times 12} \cdot a$$

We find v_1 at start of snubbing from $v_1^2 = v_0^2 + 2gS$

$v_1^2 = 0 + 2 \times 32.2 \times 12 \times 6$ $\quad\therefore v_1 = 68.3$ ips

Find a from $\quad v_f^2 = v_1^2 + 2a \cdot S$

$$0 = 68.3^2 + (2a \times 6)$$
$$a = -388 \text{ ips}^2$$

$$\therefore F = 10{,}000 + \frac{10{,}000}{32.2 \times 12} \times 388$$

$$= 10{,}000 + 10{,}000 = 20{,}000 \text{ lb}$$

(3) Determine snubber cylinder bore size by trial method. Using a 4″ diameter snubber cylinder (12.56 sq in. area) gives a pressure of

$$\frac{20{,}000}{12.56} = 1{,}600 \text{ psi.}$$

(4) Compute orifice area from $v_1 = 93\frac{A_2}{A_1}\sqrt{P_1}$

$$68.3 = 93\frac{A_2}{12.56}\sqrt{1{,}600}$$

$$A_2 = 0.231 \text{ sq in.}$$

Plug dimensions of the snubber can now be computed as in the previous example. ★

What do you know about moduli?

A better understanding of the subject enables calculations to be simplified

The use of the term "moduli" in engineering studies is very often confusing. In the studies of stresses in engineering structures, for instance, elastic moduli are usually considered. Other moduli are often mentioned, such as moduli of section and moduli of vibration.

In addition, engineers are also confronted with moduli for liquids and gases, which have become of ever increasing importance in recent years. The relation of elastic moduli to the different forms of stiffness is not always understood. Further it is not always realized that a thorough grasp of the fundamentals enables calculations to be considerably simplified.

The following study of moduli is presented as a guide for further study.

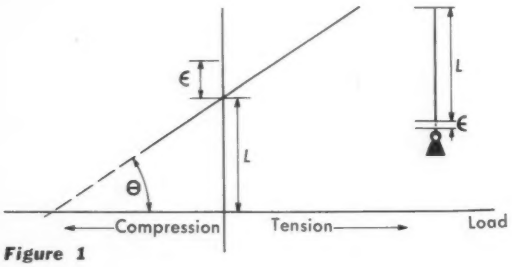


Figure 1

Modulus of elastic fiber

Consider an elastic fiber, length L. Let the load applied equal F, and consequent extension $\delta L = \epsilon$. If the fiber is perfectly elastic $\epsilon \propto L$, as defined by Hooke's Law.

Then λ = load/strain

$$= \frac{F}{\epsilon/L} = \frac{FL}{\epsilon} = \frac{\delta F \,.\, L}{\delta L}$$

The load-extension graph is then a straight line and $\lambda = \cot \theta$. This modulus we term the "Deflection Modulus", and must not be confused with the Material Modulus, which we consider next.

Young's Modulus

When we consider an elastic material in tension and compression,

$$E = \text{stress/strain}$$

$$= FL/A \text{ or } \frac{\delta F}{\delta L}\left(\frac{L}{A}\right)$$

where A = area of cross section.

If we compare this with the previous case it will be realized that while E usually applies to very small deflections as met with in engineering structures, λ usually applies to relatively large deflections. Theoretically $\lambda = EA$ and stiffness factor

$$S = \frac{\lambda}{L} = \frac{EA}{L}$$

The realization that these differential moduli exist and an understanding of the simple relationship between them should avoid confusion in practical applications.

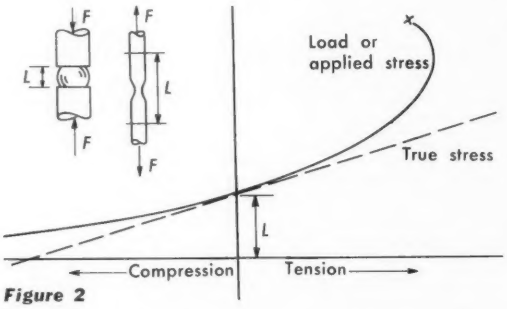


Figure 2

Engineers are familiar with tension and compression tests and that as the area cross section varies, apparent stress is given by the quotient F/A, A being the **original area** of cross section. If length is plotted against load or apparent stress, we get a curve as shown in Figure 2.

If the quotient F/A' is used (A' being the true area) a straight line graph is produced. Figure 2 shows both tension and compression, and theoretically compression could continue to zero thickness, and tension until local extension takes place. The graph is approximately hyperbolic.

Shear Modulus

Consider a material in shear as illustrated in

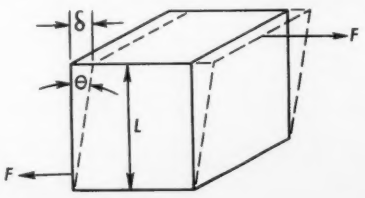


Figure 3

Figure 3.

C = shear stress/shear strain

$$= \frac{F/A}{\theta}$$

The analogy with Young's Modulus is apparent, the deformation being at right angles to the applied force.

The commonest examples of shear stress are found in the rivets in boilers and structure members which are themselves in tension or compression. Materials weak in tension, such as cast iron or concrete, exhibit sharp change of properties as the direction of load is reversed. In this case

Shear Modulus = CA

$$\text{Shear Stiffness} = \frac{CA}{L}$$

Bulk Modulus

When a material is subjected to a uniform stress in every direction, its volume is reduced. Although for most practical purposes this factor is negligible, it is of importance in engineering calculations. Bulk modulus is given by:

K = stress/volumetric strain

$= (F/A)\ (V/\delta V)$

$= (F/\delta V)\ (V/A)$

If a body is subjected to longitudinal strain, the lateral strain is given by,

m = longitudinal strain/lateral strain

where m = Poisson's Ratio (3-4 for most metals).

It is shown in strength of materials textbooks that

$$E = 2C(1 + 1/m)$$

$$E = 3K(1 - 2/m)$$

Since K and C are independent of each other, they are theoretically fundamental. In practice, E, K and C are so assumed.

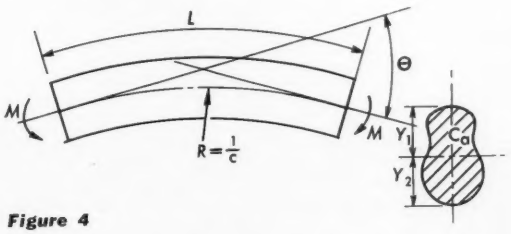


Figure 4

Bending of beams

Consider a uniform beam subject to uniform loading. In recognized texts it is shown that the neutral axis passes through the C_a of the cross-section and the following well-known formula is derived.

$$\frac{f}{y} = \frac{M}{I} = \frac{E}{R}$$

Here the analogy with tension and compression is apparent.

Tension and Compression:

$$f = \frac{W}{A} = \frac{E\epsilon}{L} \text{ (or } E \text{ . } s)$$

Bending:

$$f = \frac{M}{I/y} = \frac{Ey}{R} \text{ (or } E \text{ . } s \text{ . } y \text{ .)}$$

In the latter case the applied load becomes the applied moment M, and A becomes I/y, termed the Modulus of Section (Z). In practice, the maximum stresses are considered, the limiting values of y(y_1 and y_2) giving the Section Moduli, in tension or compression as applicable.

Bend stiffness is determined by,

$$S = \frac{M}{\theta} = \frac{Mc}{L} = \frac{MR}{L} = \frac{EI}{L}$$

where c = curvature of strain

R = radius of curvature = $1/c$

Bend modulus = $\lambda = SL = EI$

The stress f is given by $f = M/Z$

In the case of non-uniform bending $\delta = M/QEI$, Q being a factor depending on the given conditions.

Thus, $\delta/L^2 = WL/QEI$

$\delta = WL^3/QEI$

Values of Q

	Concentrated load	UDL
Cantilever beam	3	8
Pinned beam	48	384/5
Encased beam	192	384

Stress is also given by $f = M/Z$, but varies along the beam.

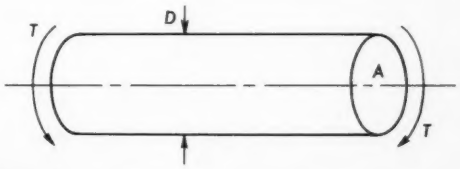


Figure 5

Torsion in shafts

Consider a uniform shaft subject to a torque at each end, as illustrated in Figure 5. Recognized texts quote the stress as:

$$f = \frac{T}{J} = \frac{C\theta}{L}$$

Here the analogy with shear stress is immediately apparent.

For skin stress, as usually considered

$r = R$ or $D/2$

and: $Z = \pi R^4/2R = \pi R^3/2$, or $\pi D^3/16$

For hollow shafts: $Z = \left(\frac{\pi}{2}\right)(R^3 - r^3)$

Torsional stiffness: $S = \frac{T}{\theta} = \frac{CJ}{L}$

Special considerations

Springs

Springs may be regarded as elastic fibers and designed accordingly. If the material shear stress

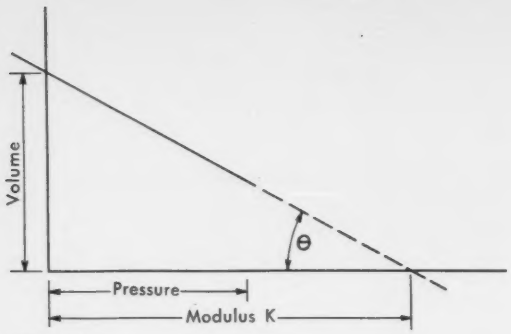


Figure 6

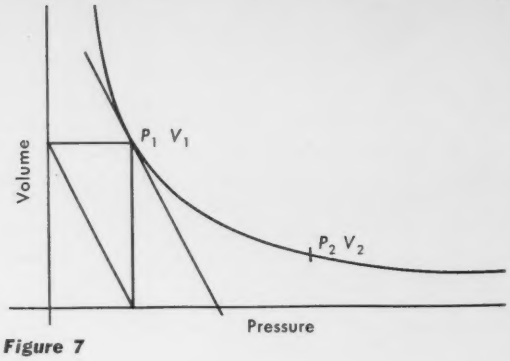


Figure 7

is to be considered, the formula given in the last column of Table I must be used. Spring stiffness (load/deflection) is often erroneously called a modulus.

Liquids

Liquids have only bulk modulus. In most liquids, compression is negligible. However, it must be considered in designing liquid springs. Hooke's Law is applicable and a straight line PV graph develops. Here again, the bulk modulus is the pressure theoretically required to compress the volume to zero. Thus we have the coefficient of viscosity

$$= \frac{\text{stress}}{\text{velocity gradient}} = \frac{F/A}{dV/dx}$$

Gases

Whereas in solids and liquids there is no initial pressure, in dealing with gases both the initial and applied pressures must be considered. Here again only bulk modulus is considered, with the related pressures and volumes. It is misleading to regard gases as "springs", and Hooke's Law does not apply.

Vibrations

The term "modulus" is also used in connection with simple harmonic motion and vibration. Simple relationships exist, including:

Vibration modulus:

$$\delta = \text{acceleration/displacement} = f/\epsilon$$

Thus $\delta = S/m = \lambda/Lm$

and $\omega = \sqrt{\sigma}$

Frequency: $\eta = \frac{1}{2\pi}\sqrt{\sigma} = \frac{1}{2\pi}\sqrt{\frac{\lambda}{Lm}}$

Period: $T = 2\pi\sqrt{\sigma} = 2\pi\sqrt{Lm/\lambda}$

In conclusion, we must emphasize that it is necessary to understand clearly the difference between "deflection modulus" and "material modulus". We should also understand the important difference between "modulus" and "stiffness". E and C are regarded as the fundamentals for tension and shear respectively, and the deflection moduli (λ, for example) are given by multiplying A, I or J as appropriate.

Values for each of the factors we have considered are given in the accompanying Table. ★

Table I

Summary of Formulæ

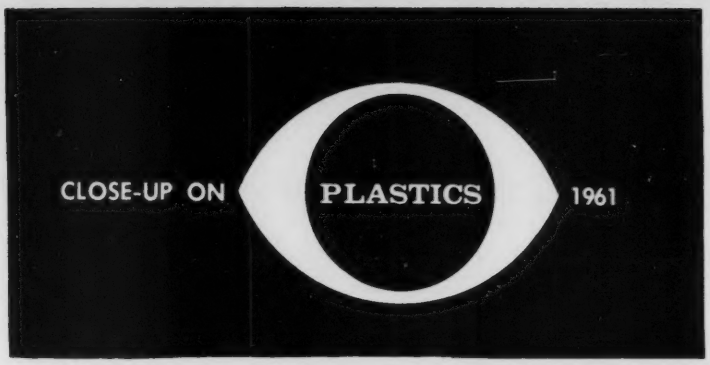
	Fiber Tension	Tension or Compression	Uniform Bending	Shear	Torsion (round)	Springs
Material Modulus	—	E	—	C	—	C
Deflection Modulus	λ	EA	EI	CA	CJ	$LCd^4/8D^3N$
Stiffness (S)	λ/L	EA/L	EI/L	CA/L	CJ/L	$Cd^4/8D^3N$
Deflection (δ)	F/S	F/S	M/S	F/S	T/S	$8WD^3N/Cd^4$
Stress	$\lambda\epsilon/L$	F/A	M/Z	F/A	T/Z	$8WD/\pi d^3$
Strain	F/λ	F/EA	M/EZ	F/CA	T/CZ	$8WD^3N/LCd^4$
Resilience	$\frac{1}{2}F^2/\lambda$	$\frac{1}{2}f^2/E$	$\frac{1}{2}\left(\frac{k}{y}\right)^2 f^2/E$	$\frac{1}{2}f^2/C$	$\frac{1}{2}\left(\frac{\epsilon}{r}\right)^2 f^2/C$	$\frac{1}{4}f^2/C$

Section Modulus	$Z = I/y$	Polar Modulus	$= J/r$
Rectangular beam	$I = bd^3/12$	$Z = bd^2/6$	$(k/y)^2 = 1/3$
Round bar	$I = \pi D^4/32$	$Z = \pi D^3/16$	$(k/y) = 1/4$
	$J = \pi D^4/64$	$Z = \pi D^3/32$	$(\epsilon/r)^2 = 1/2$

PAGES 51-52 MISSING REGISTRATION FORM.

A preview . . .

The Plastics Show of Canada



The newest in materials and applications . . . a must for designers

Engineers and manufacturers will get a glimpse of the products of the future and the materials and components that go into them when they visit the Plastics Show of Canada in Toronto this month. The show will run for three days, October 17 to 19, in the Automotive Building at Exhibition Park.

End-users, manufacturers, molders, designers and processors in Canada's $300,000,000 plastics industry will be putting their products on display in Canada for the first time in a show all their own. It is expected that 10,000 will visit the show, and almost every type of manufacturing industry will be represented by their engineering specialists and management. Here they will personally view developments within the plastics industry and study the adaptability of plastics to their own products.

One hundred and thirty companies have signed up for exhibit space and their booths will be manned by over 500 specialists in the plastics field. These specialists will be available for professional consultation, as well as answering the general run of questions about their products.

Technical societies participate

Concurrent with the show, the two leading technical associations in the plastics field in Canada will be holding special meetings.

The Society of the Plastics Industry will have a two day affair. A general dinner meeting will be featured Wednesday noon, chaired by W. S. Wood, president W. S. Wood Manufacturing Co. Ltd. Guest speaker will be Walter F. Oelman, president Standard Molding Corporation, Dayton, Ohio, and also president of the Society of the Plastics Industry.

Four divisional meetings will be held by the SPI (open to all persons interested) on Wednesday morning for group discussions. These are the reinforced plastics section, the film and sheeting division, material suppliers division and the molders division.

The Society of Plastics Engineers will also be holding its regular October meeting on the second day of the show.

Some show features

Highlight of the show for engineering designers may well prove to be the display by the Association of Canadian Industrial Designers. Their extra-large booth will illustrate the development of designs from the original desk blotter doodle to the finished product.

There is no charge for admission to the show. Preregistration tickets are available from all of the many companies taking part in the show. All visitors without special invitation tickets will be obliged to identify themselves and the industry they serve before being admitted. The only exception to this will be during the four-hour 'open to the public' period, on the Wednesday evening, when the general public will be given the opportunity to have a personal look into the world of plastics.

Remember these facts

The Show

Place: Automotive Building, Exhibition Park, Toronto

Dates: October 17, 18, 19, 1961

Hours: 10 a.m. to 6 p.m. on Tuesday and Thursday
10 a.m. to 10 p.m. on Wednesday

Registration: Free

The Conferences

Society of the Plastics Industry

Dinner Meeting: Tuesday 6 p.m., mezzanine floor, Automotive Building . . . speaker Mr. W. F. Oelman, president SPI . . . Tickets available at the show.

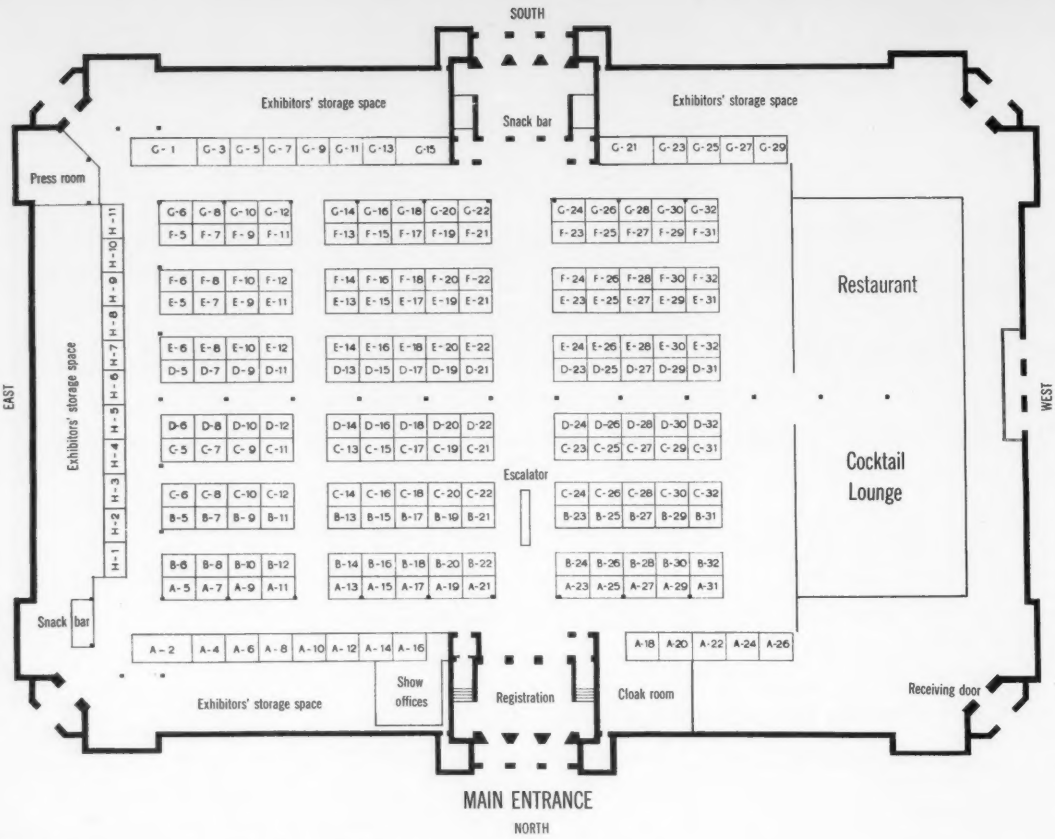
Division meetings: Wednesday 9.30 a.m., four separate meetings . . . open to all interested persons.

Society of Plastics Engineers

Special meeting: Wednesday evening, mezzanine floor, Automotive Building . . . open to all interested persons.

Use the free registration form in this issue of Design Engineering

OCTOBER 17-18-19, 1961 AUTOMOTIVE BUILDING, EXHIBITION PARK, TORONTO, CANADA



Clip out this floor plan . . .

. . . it will help you locate the exhibitors at the Plastics Show

Exhibitor	Booth No.
Advance Solvents & Chemical Corp. of Canada	C30
Allied Chemical (Canada)	G20, G22
Alsteele Engineering Works	A23 to B32
Argo Plastics & Chemicals	F31
Argus Chemical	B17
Association of Canadian Industrial Designers	A5, A7, B6, B8
Auto-Blow	A23 to B32
Auto-Vac	A23 to B32
Avisun Corp.	A15, A17, B16, B18
Ball & Jewell	A5, A7, B6, B18
Barker Industrial Equipment	A20, A22
Bata Engineering	C18
Biltex	G28
Binks Mfg. of Canada	E13
B.I.P. Chemicals and Engineering	D30, D32
Blackfriars Engineering	G21
C. W. Brabender Instruments	B13
Bradley & Turton	B9, B11, C10, C12
Bridgeport Machinery	A5, A7, B6, B8
Brunswick of Canada	A19, A21
Cana Plastic Co.	B20
Canada Colors & Chemicals	F21
Canadian Plastics Magazine	E15
Capri Fibre Glass Products	H11
Chemical Oil & Resin	A10
Christy & Norris	B9, B11, C10, C12
Coating Products	E27
Commercial Marking System	C13
Comet Industries	A5, A7, B6, B8
Conforming Matrix	C15, C17
Cosa Corp. of Canada	A18
Courtauld's Plastics (Canada)	A15, A17, B16, B18
Crystal Glass & Plastics	C16
T.H. & J. Daniels	H1
Barnett J. Danson & Associates	A23 to B32
Davenport Containers	B19, B21
Davis Automatic Controls	D27
Daymond	G10, G12
Delamere & Williams	A9, A11, B10, B11
Devcon	A16
Dillon's Chemical	F14, F16
Dominion Electrohome Industries	A14
Dominion Rubber	C19, C21, D20, D22
Dubuit	G14
Eastman Chemical Products	B23, B25
Edmir Molding	F17
Emery Industries (Canada)	G15
Englehardt	G21, G25
English Plastics	G13
Enjay Chemical	E24
Farris Universal Machine	A23 to B32
Ferro Enamels (Canada)	G3
F. & H. Plastics	B27
Fiberglas (Canada)	D29, D31
Glassfiber Company	E29
Glenn Electric Heater	A23 to B32
Glidden	C27
G.M. Plastic	C23, C25
B.F. Goodrich (Canada)	F23, F27, G24, G28
Graham Products	A26
Harchem	D17
Husky Plastics Machinery	H3, H4, H5
Iddon Brothers	B9, B11, C10, C12
Improved Machinery	G7, G9, G11
Industria (Ore & Chemicals)	H7
Industrial Plastics (Canada)	B22
Kay Machine	F29
Kayson Rubber & Plastics	D24, D26
Krieger Color & Chemical	G21 to G25
W.T. Larose & Associates	B9, B11, C10, C12
Lawter Chemicals (Canada)	G18
Lester Engineering	H1
McArthur Chemical	G29
Marbon Chemical	F14, F16
Masson, Seeley	D19, D21
Midland Plastics	E19, E21
H.J. Miller Enterprises	E29, E31
Mobay Chemical	A24
Mokon Div., Protective Closures	A23 to B32
A.R. Monteith	C14
Morval Products	E18
Multi Plastics	D18
National Rubber Machinery	A23 to B32
Naugatuck Chemicals	C19, C21, D20, D22
Negri Bossi	H8 to H10
Nuodex Products of Canada	E28
Paisley Products of Canada	E23
Paper Sales	E27
Peco Machinery	A20, A22
Peerless Engineering	B9, B11, C10, C12
Peuchen	A23 to B32
Phoenix Manufacturing	C32
Plastal Manufacturing	C29, C31
Plastic Equipment & Accessories	H8 to H10
Plastiline	A23 to B32
Polyfiber	D28
Prodex	D23, D25
Protective Plastics	E30, E32
Reichhold Chemicals	B29, B31
Reifenhauser U.S. Sales	F27
Reynolds Aluminum Canada	G27
Richmond Plastics	A8
Rohm & Haas	C24
Rosedale Plastics International	C20, C22
Scepter Mfg. Co.	F20, F22
Scott's Screen Process Supplies	G14
Francis Shaw (Canada)	E14, E16, D13, D15
Sherbrooke Machineries	G7, G9, G11
I.F. Slessor	C24
Society of Plastics Industry (Canada)	F5, F7, G6, G8
John Sperling	D30, D32
Standard Tool	A23 to B32
Stanley Chemicals	G31
Sterling	A5, A7, B6, B8
Sun Oil	F11
Thermovolt Instruments	B13
Toronto Gold Leaf	H6
Toronto Plastics	C28
Tough Plastics	D14
Tronomatic Machine Mfg.	H10
Turner Machinery	G21, G25
United Shoe Machinery Canada	G32
Van Dorn Iron Works	A23 to B32
Watson-Stillman Press	A23 to B32
Weber Marking Systems	C13
Whitlock Associates	A23 to B32
A.R. Williams Machinery	H1
John Williams Machinery	B9, B11, C10, C12
Wilmod Machinery	G21, G23, G25
R.H. Windsor of Canada	A2, A4, A6
W.S. Wood Machinery	A5, A7, B6, B8
Matthew Wylie (Canada)	A3

Crashing cars to design safer barriers

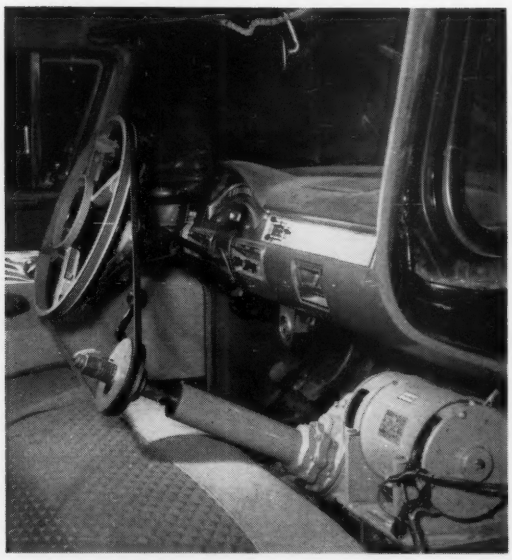
Old police cars are the guinea pigs in experiments for safer highways

Automobile accidents occur on schedule at Cornell Aeronautical Laboratory, Buffalo, N.Y.

In the interest of highway safety, cars are being cracked up to determine how future highway guide rails and similar barriers should be designed. The research program, which has demolished four autos in as many tests, is sponsored by the New York State Department of Public Works with financial assistance from the federal Bureau of Public Roads.

One of the main purposes of the program, according to Norris E. Shoemaker, project engineer, is to obtain a detailed understanding of barriers subjected to vehicle impact that can be applied for design purposes. "Until now," he explained, "the familiar fences which line our highways have been designed from experience —not true scientific knowledge."

Shoemaker's preliminary report reveals important differences in the extent of hazards involved in striking barriers of various types at sharp angles and high speeds. The impact is often too sudden, causing occupants of the auto to be seriously injured.



Remote control unit enables crash car to be operated by radio during tests.

Paradoxically, one of the factors which led to the research program by New York State was the increasing use of modern, "safer" highways. Widespread use of expressways and parkways has greatly reduced the automobile accident rate, but not eliminated it. The periodic occurrence of cars going out of control and crossing median sections of divided highways has contributed to the decision to conduct the current research program.

Future barriers, described as continuous structures at the edges of roads, are likely to be built to protect rather than warn.

Cornell is expanding the research previously accomplished in the field, thereby gaining a better understanding of the variables that influence barrier—vehicle performance.

Once an understanding is reached, it should be possible to cope with new vehicle and highway developments without continually resorting to test programs.

Barriers as deflectors

What does Mr. Shoemaker think the barrier of the future will be?

"When impact occurs, a successful barrier will redirect the vehicle along a path parallel to the barrier. The vehicle will then be stopped gradually instead of suddenly—as is often the case today.

"The problem isn't simply devising a means of preventing vehicles leaving the highway. The barrier should hold or deflect the vehicle back onto the roadway with minimum obstruction to traffic and with minimum injury to occupants."

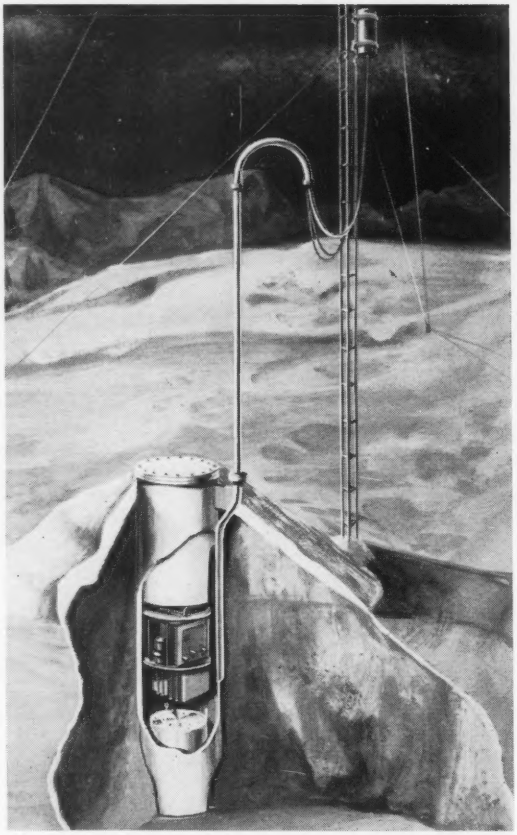
The basic research problem arises in predicting the level of protection offered by a given highway barrier system under crash conditions. In the research approach adopted by CAL, engineers have crashed obsolete State Police cars into various types of barriers to collect experimental data for verifying the analytical phase of the program.

A network of electronic and photographic equipment was devised to record findings. Engineers traveling in a "chase car" operate the crash vehicle by radio control, sending it into the barrier at a predetermined speed and angle.

Many days, even weeks, are spent preparing for a test which is over in a matter of seconds. Instrumentation must be checked and rechecked. When the test is finally conducted, the car must hit a precise spot on the barrier if findings are to be recorded accurately. ★

Designews in pictures

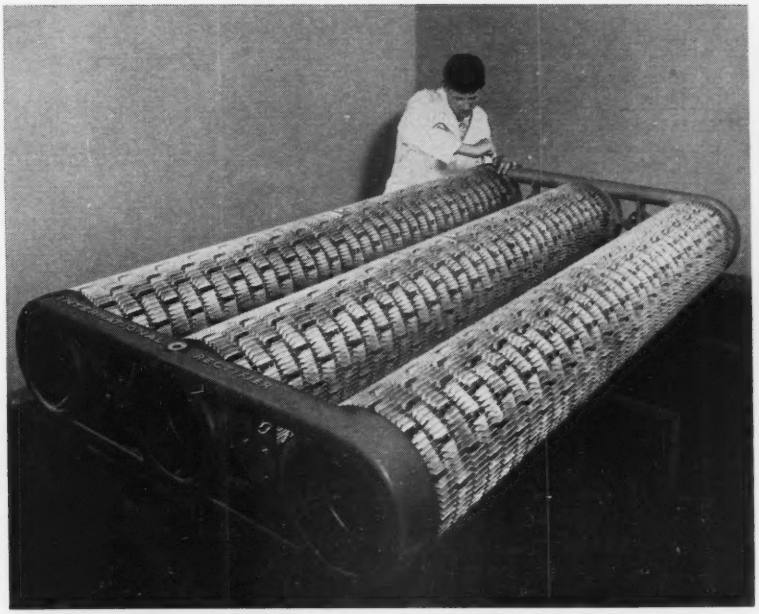
Thrust of more than one million pounds streams from F-1 rocket engine during tests that may hasten man's moon flight.



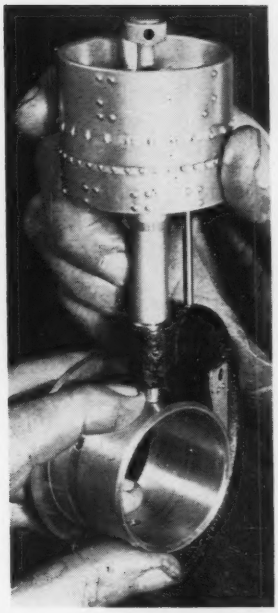
Artist's view of world's first atomic weather station now automatically flashing reports from Canada's icy north.

Washable shield of spun cellulose acetate and opal diffuser are features of this British award-winning lampshade.

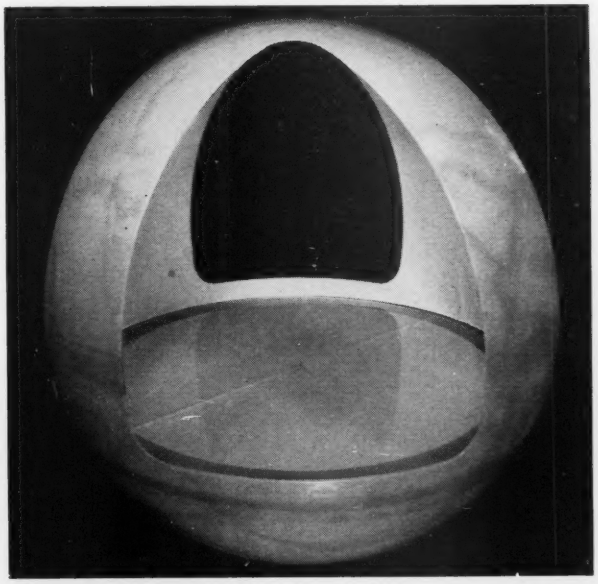
Draped around exterior of this vacuum drier is the mate to world's biggest O-ring that seals its end flanges.



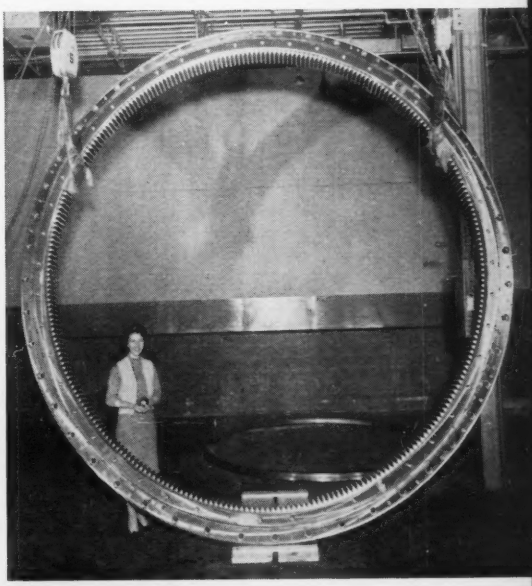
Herculean rectifier bridge rated at 35,000 volt dc and 55 amps represents last stage in replacement of power vacuum tubes by solid state physics devices.



Micrometer with drum graduated in Braille characters helps the blind to find useful technical employment in industry.



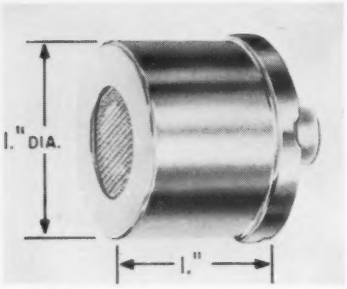
Three-foot diameter sphere of glass fiber/resin was manufactured for experimental radar work.



One of seven huge precision ball bearings, 13 feet in diameter, made to support giant radar antennae.

New products and materials

Ultrasonic transducer



A precision transceiving ultrasonic transducer suited to such applications as command signaling and intercom systems. The unit driven by either electron tubes or transistors. **Atlas Instrument Corp.**

Circle 301 on Reader Service Card

Tunnel diodes

Four new microwave frequency germanium tunnel diodes housed in miniature packages. They feature tightly controlled low peak currents and high negative resistance. **Canadian General Electric Co.**

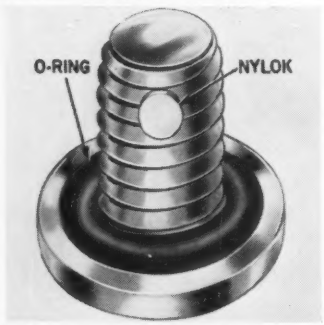
Circle 302 on Reader Service Card

Power transistors

A series of four intermediate power transistors claimed to have the highest voltage rating in the industry. The silicon diffused mesa transistors have a 150 volt and 200 volt maximum rating and sustaining voltages of 125 and 140 volts. **Transistron Electronic Corp.**

Circle 303 on Reader Service Card

Self-sealing fasteners



High-pressure self-sealing fasteners with a resilient nylon pellet imbedded in the threaded area for added reliability and thread locking action. The pellet supplements the locking action of the O-ring under the fastener head. **A. T. R. Armstrong Ltd.**

Circle 304 on Reader Service Card

Globe-type valves

A new concept in the design of globe-type valves for chemical, food, petroleum and other processing industries. Non-rotating stem and non-rising handwheel and fixed disc claimed to eliminate stem vibration and disc chatter as well as galling between stem foot and disc. **Alloy Steel Products Co.**

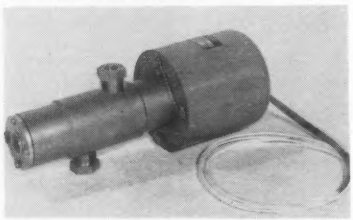
Circle 305 on Reader Service Card

High-speed valve

Valve with three-inch-diameter orifice closed by a poppet held in place by a double toggle assembly that is tripped by a solenoid. Only nine milliseconds after the solenoid plunger starts moving the valve seal is broken, and six milliseconds later the port is wide open. Maximum operating pressure is 1500 psi. **Beechey Enterprises.**

Circle 306 on Reader Service Card

2-way solenoid valve



New valve which can be changed in the field from normally open to normally closed by interchanging parts within the valve. It is explosion-proof and controls fluids or gases, including helium, at pressures up to 3,000 psi. **Vinson Mfg. Co.**

Circle 307 on Reader Service Card

Ball bearing

A new ball bearing in a flange-type iron housing of special application in the farm machinery and airconditioning field. The bearing face on the collar is located flush with the face of the casting in such a way that water will not puddle when mounted for vertical shaft application. **United Steel Corp. Ltd.**

Circle 308 on Reader Service Card

Variable transformer

A new transformer featuring gold alloy plated commutator, square base design and reduced over-all height and space behind panel. Output ratings up to 3.75 amps with constant current loads and up to 5.5 amps with constant impedance loads. **The American Superior Electric Co. Ltd.**

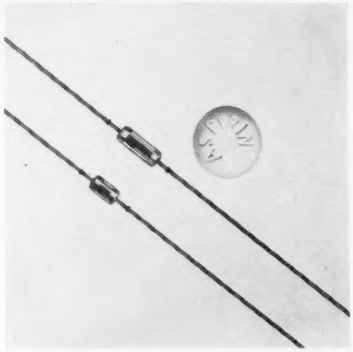
Circle 309 on Reader Service Card

Miniature crystal

Tiny relay weighing only .35 ounces is so small it can be used standing up without increasing the thickness of printed circuit package sandwiches. Prototypes are undergoing final tests and the half-sized crystals should be available commercially in a few weeks. **Brian Engineering Ltd.**

Circle 310 on Reader Service Card

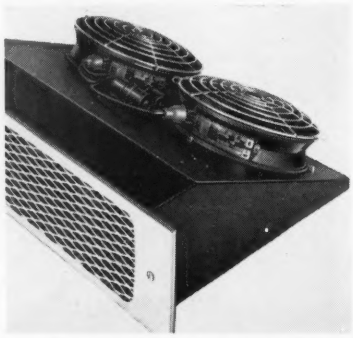
Small film resistors



Two new micro-miniature carbon film resistors claimed to be the smallest of their kind. One rated at 1/10 of a watt has a body length of .156″ by .090″ body diameter. The other rated 1/8 watt is .281″ by .090″. **Pyro Film Resistor Co.**

Circle 311 on Reader Service Card

Cabinet fans



A unit with two flushing fans working in parallel, producing a delivery of 450 cfm free delivery, or 400 cfm at .1 wg static pressure. A special material noise-insulates the twin fans from the metal assembly. Impingement type filter is washable. **The Hoover Co. Ltd.**

Circle 312 on Reader Service Card

Ratchet-free stepper

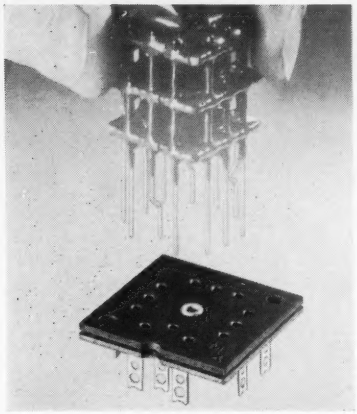
An extremely thin, quiet stepper motor operating on low voltage and eliminating mechanical ratchets. Featuring an extremely low radiated magnetic field does not require mechanical one-way devices, electrical contacts or a commutator. May be operated with windings continuously energized in static condition or pulsed at

New products — *continued*

rates up to 2,400 steps per minute. **Philips Electronics Industries Ltd.**

Circle 313 on Reader Service Card

Module socket



Claimed to be the first socket to accept module resistor and capacitor stacks. Insulating wafers are NEMA grade XP chocolate. Brass contacts are barrel-type, cadmium plated. **Illinois Tool Works.**

Circle 314 on Reader Service Card

Silicon diodes

Developed to eliminate arcing and erosion across miniature relay contacts, a new series of eight subminiature masa diffused junction silicon glass diode contact protectors provides a maximum working voltage range from 30 to 300 volts, with maximum coil current rating of 1.25 amps. **Douglas Randall (Canada) Ltd.**

Circle 315 on Reader Service Card

Spray nozzles

Non-corrosive spray nozzles with butyrate injection molded follow cone allowing uniform spraying pressures below 2 psi. Non-porous plastic material resists mineral build-up and withstands above boiling and below freezing temperatures. **Austin Manufacturing Corp.**

Circle 316 on Reader Service Card

Polyester resin

A new resin for corrosion applications. Has added thixotropic quality and lower viscosity making it ideal for hand lay-up or spray gun application. Impregnation without drain-out makes it useful for vertical surfaces. **Naugatuck Chemicals.**

Circle 317 on Reader Service Card

Self-bonding rubber

A new family of self-bonding silicone rubber compounds and reinforced gums that afford a primerless bond to ferrous-containing metals stronger than the highest strength silicone rubber. Claimed they will cut the number of steps involved in the bonding process by half. **Canadian General Electric Co Ltd.**

Circle 318 on Reader Service Card

Appliance switch

A low-cost snap action switch designed for manual or mechanical operation of vending machines, refrigerators and other appliances. Requires less than one cu. in. of behind-panel space. **Honeywell Controls Ltd.**

Circle 319 on Reader Service Card

High-speed probe

New high-speed probe with a C.P. platinum sensor hermetically sealed and protected in a 316 stainless steel sheath. Response speed for one time constant is less than 300 milliseconds. **RdF Corp.**

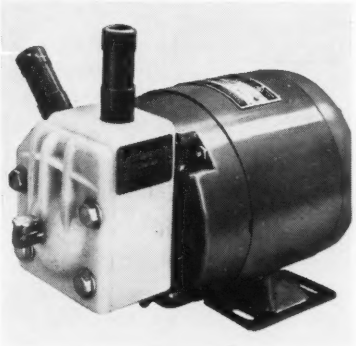
Circle 320 on Reader Service Card

Asbestos-base plastics

Two new reinforced plastics with asbestos base and proprietary phenolic resins. Materials were developed specifically for rocket components and other high temperature applications. **Taylor Fibre Co.**

Circle 321 on Reader Service Card

Plastic pump



A compact low-cost plastic pump with no stuffing boxes nor shaft seals. Measuring only 6 x 8 x 11 ins., it is intended for applications such as vending machines, plating equipment, bottle fillers and laboratory equipment. **Hayward-Gordon Ltd.**

Circle 322 on Reader Service Card

Mechanical seal

A new seal assembly designed to serve high-pressure applications from 600 to 2000 psi and peripheral speeds to 5000 ft./min. Seal utilizes a tung-car sealing member to withstand additional loading. **Duramettalic Corp.**

Circle 323 on Reader Service Card

Designers' book shelf

Electrical Engineering Fundamentals, by J. P. Neal, Department of Electrical Engineering, University of Illinois. Publisher — McGraw-Hill, Toronto. 400 pages. Price $9.75.

This is a thorough presentation of the fundamental theoretical electrical engineering concepts in terms of appropriate mathematics, illustrated by practical applications to simple electromagnetic phenomena and structures.

Written in typical textbook style, the book commences with steady current fields and then progresses through electrostatic fields, magnetic fields and electromagnetic fields. It introduces the fundamentals of linear electric network theory.

Circle 324 on Reader Service Card

Mechanization of Motion, by Lee Harrisberger, Associate Professor of Mechanical Engineering, North Carolina State College. Publisher—John Wiley & Sons, New York. 360 pages. Price $8.50.

This book is intended primarily to present rational procedures for the synthesis of mechanisms. It combines the fundamentals of kinematics, the techniques of ideation, and new techniques of analysis. This is one of the few books that we have read which introduces the reader to the process of creating designs which satisfy a realistic need.

The author has had 13 years as a Fellowship for advanced study at Purdue University.

Circle 325 on Reader Service Card

"When you've completed your furnace tending, sweeping, and filing duties, you'll be free to squeeze in as much designing as you can."

Structural steel standards

For your guidance, here are some standards pertinent to the design, fabrication and erection of structural steelwork. As these standards relate to Canadian practice, it is recommended that they be used wherever possible.

There are a number of differences between Canadian design specifications and the present specifications of the American Institute of Steel Construction. Differences exist, for example, in allowable stresses, column design, plate girder design and open-web steel joist design to an extent which renders parts of the AISC Manual inapplicable in conjunction with Canadian Specifications.

It should be noted that CSA S16-1961 and Section 4.6 of the National Building Code of Canada (1960) are identical in technical content as regards structural steel design. Design requirements are based on either elastic or plastic theories of behaviour. Standard requirements for the design of open-web steel joists are included in these. The National Building Code also contains provisions governing open-web steel joist construction, consisting of joists, decking and ceiling, if any.

Materials

Canadian Standards Association G40 series, "Specifications for Structural Steel", and in particular:

- CSA G40.1—General requirements for delivery of rolled steel plates, shapes, sheet piling and bars for structural use.
- CSA G40.4 — Medium structural steel.
- CSA G40.8 — Structural steels with improved resistance to brittle fracture.

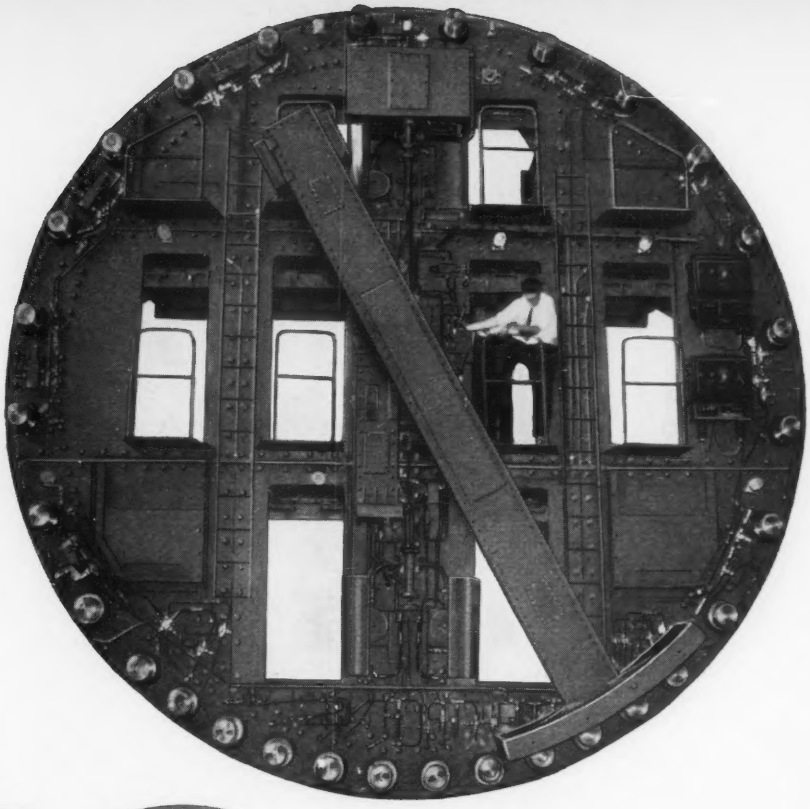
American Society for Testing Materials Specifications for rolled structural steel, and in particular:

- ASTM A6 — General requirements for delivery of rolled sheet plates, shapes, sheet piling and bars for structural use (Similar to CSA G40.1).
- ASTM A7—Steel for bridges and buildings (similar to CSA G40.4).
- ASTM A36—Structural steel.
- ASTM A242—High-strength low alloy structural steel.
- ASTM A373 — Structural steel for welding.
- ASTM A440—High-strength structural steel.
- ASTM A441—High-strength low alloy structural manganese vanadium steel.

Design & fabrication

- CSA S1—Steel railway bridges.
- CSA S6 — Steel highway bridges (now under revision).

(Continued on page 63)



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50 feet below busy downtown traffic in Toronto, a giant shield moves slowly forward. At regular intervals, the great arm places in position the liners which form the walls of the city's new subway extension. The shield, illustrated above, one of six produced, is a huge complex of hydraulic jacks, each exerting 110 tons thrust. They are mounted, with controls, in a precision machined fabricated steel frame. Note the man standing in one of the compartments during shop testing. Shields and lining (22,000 tons of machined cast iron segments) were produced by Canada Iron.

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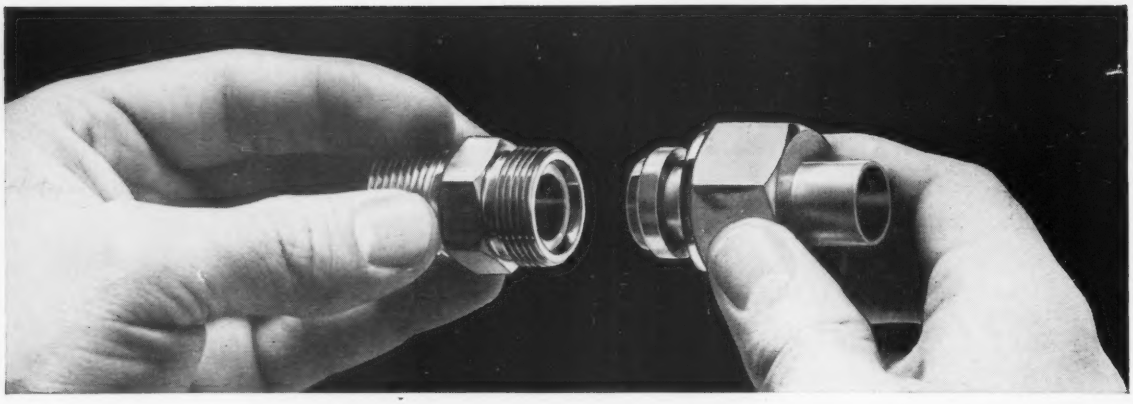
SOLUTION:

BRAZE-SEAL



THIS BUTT-JOINT, MAKE-AND-BREAK FITTING WITHSTANDS WORKING PRESSURES UP TO 19,000 P.S.I.*

On many installations where you think only a more costly welded tube fitting can do the job, this Imperial butt-joint BRAZE-SEAL fitting now takes over. It's a compact, economical, simple-to-install fitting withstanding *super* working pressures (see table). It won't yield to high-frequency vibration or shock. With special brazing alloy rings, this fitting withstands temperatures up to 1500° F.

Because Braze-Seal fittings are not welded, you retain the convenience of a make-and-break joint. For more details, call your nearby Imperial-Eastman distributor—or write for Bulletin 3120.

MAXIMUM DESIGN PRESSURES FOR BRAZE-SEAL FITTINGS		
Tube O.D.	P.S.I.—316 Stainless	P.S.I.—Carbon Steel
¼"	77,000	60,000
⅜"	64,000	48,000
½"	62,400	46,800
9/16"	61,600	—
⅝"	61,600	46,200
¾"	60,000	45,000
⅞"	56,000	42,000
1"	52,000	39,000
1¼"	48,000	36,000
1½"	44,000	33,000

*Recommended working pressures allow for 4-to-1 safety factor on sizes up to ¾" O.D.; 6-to-1 on sizes ¾" to 1½" O.D.

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Structural steel standards — *continued*

- CSA S16—Steel structures for buildings. (1961 edition)
- CSA W59—Welding of steel structures.

Codes

National Building Code of Canada (1960 edition), Welding Qualification Code (CSA W47), CISC Code of Standard Practice for Structural Steel for Buildings.

CSA standards are obtainable through Canadian Standards Association, 235 Montreal Road, Ottawa 2. The National Building Code is available through the National Research Council, Ottawa.

New standards

The following new standards have recently been published. They are available through Canadian Standards Association.

CSA Standard B150.13-1961 — Gas-Fired Gravity and Forced Air Central Furnaces:

This covers minimum requirements for safe operation and acceptable performance of gas-burning appliances and equipment and all electrical equipment, wiring, and accessories built in, or supplied for use with gas-fired central furnaces. Minimum requirements of design, construction, manufacture, and testing are covered. It applies to automatically operated gas-fired central furnaces for use with natural gas; for use with natural, manufactured or mixed gases; for use with liquefied petroleum gases; or for use with LP gas-air mixtures. **Price: $4.50**

C22.2 No. 114-1961 — X-Ray Equipment:

This standard applies to portable mobile, and stationary X-Ray equipment for supply potentials of 600 volts and less for general, industrial, commercial, and medical (diagnostic and therapeutic) applications in ordinary (non-hazardous) locations. It also covers radio-active isotope and electron-beam type equipment insofar as it applies. **Price: $2.25**

CSA Standard C22.2 No. 47-1961 — Air-Cooled Transformers (Dry Type):

This new edition applies to single and polyphase air-cooled transformers (including auto-transformers) of the dry type for supplying voltage to power and lighting circuits and designed to be installed and used in accordance with the Canadian Electrical Code, Part I.

It also applies to multi-winding transformers up to and including 150kva, 5kv single-phase and 8.66kv polyphase and to auto-transformers of the equivalent two-winding capacity; and to transformers for industrial and commercial use in ordinary (i.e. non-hazardous) indoor and outdoor locations. **Price: $1.00**

CSA Standard C22.2 No. 3-1961 — Electrical Features of Fuel Burning Equipment (Gas and Oil):

This new edition applies to the electrical features of gas- and oil-burning appliances and equipment, which are intended to be installed and used in accordance with the Canadian Electrical Code, Part I in ordinary (non-hazardous) locations on supply circuits of 600 volts and less. It covers the electrical features of appliances and equipment such as warm air, hot-water and steam-heating equipment, room heaters, cooking ranges, combination ranges, incinerators, industrial processing equipment and industrial heating and cleaning machines. **Price: $2.25**

G40.8-1960 — Structural Steel with Improved Resistance to Brittle Fracture

This is a new addition to the G40 Series of Standards for Structural Steel. It covers steel plates, shapes, and bars suitable for the welded, riveted, or bolted construction of bridges, buildings, and other structures where improved resistance to brittle fracture is desired. This Standard offers three grades of steel which have progressively improved resistance to brittle fracture. The Standard is limited to material having thicknesses up to 1½ inches maximum, supplied in the "as-rolled" condition. **Price 35 cents**

D106-1961 — Lighting for commercial vehicles

This edition applies to wiring for lighting on commercial vehicles, particularly relating to towed vehicles or trailers and to detachable electrical connections between towing and towed vehicles. **Price $2.75**

Binders for CSA Standards:

For binding a small number of CSA Standards into a convenient-to-use booklet, CSA now offers a stiff paper, loose-leaf binder with two pin-type fasteners. This binder is green in colour to match that recently adopted for CSA Standards and has the words "CSA STANDARDS" and the CSA Monogram printed on the front cover. Binders are available at 25 cents each. The Deluxe, 2½ inch binder is still available at $3.50 each.

Designs to reinforce metal stampings

Here's Frederico Strasser's interpretative guide to the reinforcing techniques, and a comparison of the results to be expected

It is a well-known fact that metal stampings are usually not calculated for strength. They are normally designed for convenience of production and correct performance. Their dimensions are determined empirically, depending on the function of the component and the personal judgment and experience of the designer.

The testing of samples before actual production is generally relied on to give a good indication of the correctness of the design. However, there are cases of highly stressed stampings which break down during the testing processes, because of insufficient strength. These designs must be checked for strength and redesigned accordingly.

Weak stampings may be made stronger by either employing heavier gauge material or by using lighter gauge stock (or the same gauge) with structural reinforcing. Since in a metal stamping the chief cost factor is the raw material employed for the production, in the majority of cases it is more convenient to use the lighter stock and rely on some suitable reinforcing method.

It is the purpose of this article to define the strength calculations for a few characteristic reinforcing methods for sheet metal stampings and the amazingly favorable results obtained by their application. The intention is not to present the basic data (fundamental and derivative formulae) which are more or less easily found by the average engineer in a handbook, but to present the interpretations of the facts and the interesting comparisons of the different cases.

Basic assumptions

For simplicity's sake, this article deals only with one type of load, viz., bending (flexure), which is the type of load to which metal stampings are more commonly subjected.

Strength of materials texts teach that in the case of a cantilever beam stressed with a concentrated load at the free end, for bending, the deflection is

$$f = \frac{PL^3}{3EI},$$

where

P = load in lb
L = free length in inches
E = modulus of elasticity, in lb/sq inch
I = moment of inertia, in inches^4.

This means that in the case of a component having a given length, made of a certain material, and subjected to a definite load, the deflection is inversely proportional to the moment of inertia. The latter in its turn depends only on the cross-sectional shape of the component.

It should be noted that, if the beam is of any design (simple or complicated, or the load distributed or concentrated), the deflection is always inversely proportional to the moment of inertia.

Strengthening by flanges

Let's take a look at an actual example from which we obtained the following interesting results.

When the stamping was made from plain, flat stock (width 2″, and thickness 0.1″) the moment of inertia was:

$$I = \frac{bd^3}{12} = \frac{2 \times 0.1^3}{12} = 0.000167 \text{ inch}^4.$$

Although a single flange would be of considerable help, usually a double flange (that is, a channel) is preferred because such design allows better load distribution conditions.

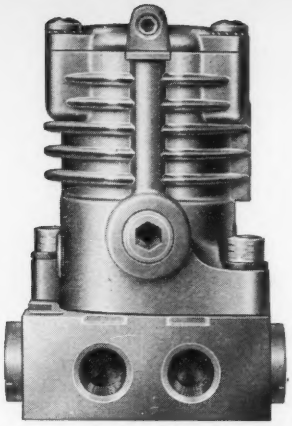
The smallest permissible height of flange is about twice the stock thickness. Taking this value, we have,

$$I = \frac{2td^3 + ht^3}{3} - A(d - y)^2,$$

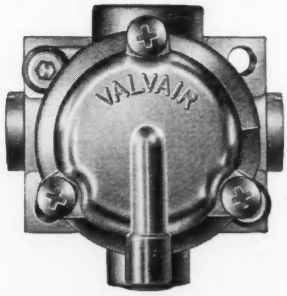
where

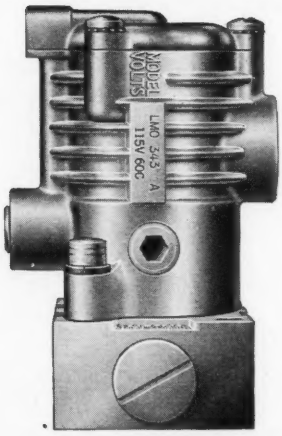
A = area of section
y = distance from neutral axis to extreme fiber.

(Continued on page 66)



good things come in small packages!





Especially Valvair's Mini-King low-cost, miniature four-way valve . . . ideal for control of small double-acting cylinders and similar devices!

Valvair's Mini-King is remarkably compact . . . a mere 2⅞ inches wide—4 inches high . . . 37½ ounces light! And, it's lightning fast, too. Valvair ingenuity provides 4-way action with a standard Speed King pilot and a pressure-balanced shuttle in the lower body. Shuttle, stainless steel pilot plunger, piston and spring—are the only moving parts. Here's both performance and built-in multi-million cycle dependability!

Pilots built to JIC standards . . . 2 point mounting . . . 15-140 psi pressure range . . . ¼ in. NPT ports . . . solenoid coils guaranteed against burn-out for the life of the valve, for ac or dc, most voltages . . . optional integral junction box and manual over-ride . . . Valvair's Mini-King offers them all! For better performance—at lower cost—put this mighty midget to work on your equipment—soon!

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Stampings — *continued*

Now

$$A = db - h(d - t) = 0.3 \times 2 - 1.8(0.3 - 0.1)$$
$$= 0.24 \text{ inch}^2.$$

$$y = \frac{d - (2d^2t + ht^2)}{2db - 2h(d - t)}$$

$$= \frac{0.3 - (2 \times 0.3^2 \times 0.1 + 1.8 \times 0.1^2)}{2 \times 0.3 \times 2 - 2 \times 1.8(0.3 - 0.1)} = 0.225 \text{ inch.}$$

Thus,

$$I = \frac{2 \times 0.1 \times 0.3^3 + 1.8 \times 0.1^3}{3} - 0.24(0.3 - 0.225)^2$$
$$= 0.0011 \text{ inch}^4.$$

This corresponds to an increase in strength in relation to the original design of about 5.6 times, while the stock used has been increased only by 20%, from 0.20 inch² to 0.24 inch².

Increasing the leg length of the flanges increases the moment of inertia considerably. Table 1 gives the exact figures for six different leg lengths.

Effect of lengthening flange legs

Table 1

length of leg	y	area	increase of area	moment of inertia	increase of moment of inertia
nil	0.05	0.20	..	0.000167	..
0.3	0.225	0.24	20%	0.0011	560%
0.5	0.379	0.28	40%	0.0062	3,600%
0.7	0.52	0.32	60%	0.0162	9,600%
0.9	0.65	0.36	80%	0.0278	17,000%
1.1	0.40	0.40	100%	0.0500	30,000%

Combined shapes are easy

For elementary regularly shaped sections (rectangular, square, channel, circular, etc.) the moment of inertia about an axis passing through the centre of gravity is easily found in engineering handbooks. Alternatively, for irregular combined shapes the engineer must calculate the moment of inertia of the whole system. For this purpose the whole area should be divided into smaller regular elements which are easier to calculate.

In the case of rectangular section portions (when the contour lines are parallel or perpendicular to the neutral axis of the whole shape) the calculation is quite easy. The procedure consists of the following steps:

- subdivide the cross-sectional area into regular elements with lines parallel and perpendicular to the neutral axis
- select a convenient auxiliary axis parallel to the neutral axis
- tabulate all the basic and calculated data about each portion, as related to the auxiliary axis . . . this should include dimensions, area distance from auxiliary axis and moments of inertia
- add partial areas, partial moments and partial moments of inertia
- divide the sum of the moments by the sum of the areas, to give the distance between the auxiliary axis and neutral axis

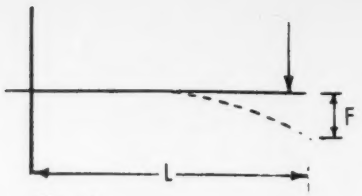

Fig. 1

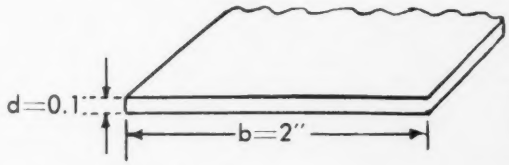

Fig. 2

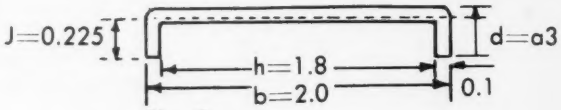

Fig. 3

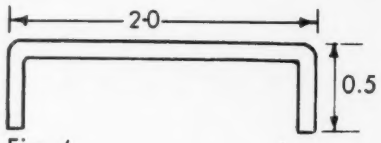

Fig. 4

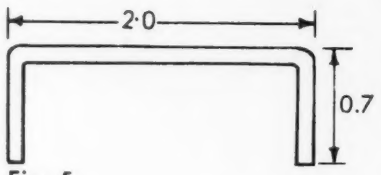

Fig. 5

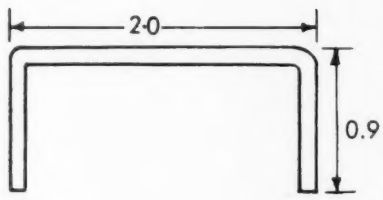

Fig. 6

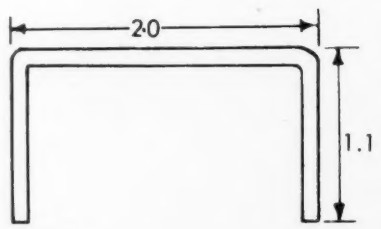

Fig. 7

(Continued on page 68)

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Nearly every elevator installed in Canada today employs Hammond Transformers in its power control system.

Hammond has developed and produced transformers to over 57,000 different designs . . . and specializes in the type of requirement where specifications and applications are severe, or even unique.

Hammond does not claim that it can solve every transformer problem without design compromise, but it does claim to have a history of success with tough transformer problems which other suppliers were either unable, or unwilling to tackle.

Your enquiries are invited.

This "Otis" installation in the new Imperial Oil Building, Toronto, utilizes 53 Hammond Transformers.

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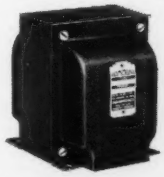

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Stampings — *continued*

• the moment of inertia for the whole system with reference to the true neutral axis can now be obtained by subtracting from the sum of the partial moments of inertia with respect to the auxiliary axis, the product of the total area times the square of the distance between the neutral axis and the auxiliary axis.

Calculations for irregular shapes

Figure 8 shows a practical application of the theory outlined in the prior paragraphs. Here we took a workpiece similar to that used in our first calculations, and added to it two short horizontal legs. The figures we tabled were:

section portion	width inches	height inches	area inch^2	moment inch^3	moment of inertia about axis F-F inch^4
I	2 × 0.2	0.1	0.04	0.002	0.00013
II	2 × 0.1	0.3	0.06	0.009	0.0018
III	1.8	0.1	0.18	0.045	0.0114
Totals	..	..	0.28	0.056	0.013333

The distance d between the auxiliary axis and the neutral axis is 0.2 inch, consequently

$I_{xx} = 0.01333 - 0.28 \times 0.2^2 = 0.00213$ inch^4.

In this case an increase of 16.7% in area of material brought an increase in strength of almost 100%.

Compound bends

Since the moment of inertia is based on only one axis around which are grouped the various portions of a given section, for our considerations it does not matter in which direction the different legs of a workpiece are bent, so long as they are parallel to the neutral axis.

Take for instance, the piece shown in figure 9. It must be treated exactly as the part shown in figure 8, and so the moment of inertia about the neutral axis is the same in both cases.

Where shapes include curved portions, the calculation of the moment of inertia is analogous to that of the method described previously (see under "Combined Shapes"), with slight modification to take care of the curved portions.

Workpieces reinforced with rounded ribs (beads) represent the simplest example of curved part handling. Figure 10 is a good example.

section portion	width inches	height inches	radius max	radius min	area inch^2	moment of inertia inch^4
I	1.4	0.1			0.14	0.00047
II			0.3	0.2	0.0785	0.002542
Totals					0.2185	0.003012

Since $d = 0.09$ inches,

$I_{xx} = 0.003012 - 0.2185 \times 0.09^2 = 0.00124$ inch^4.

Comparing this result with our previous ones, we find that for an increase in material of less than 10% with respect to the original design, we have

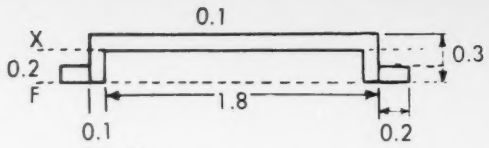

Fig. 8

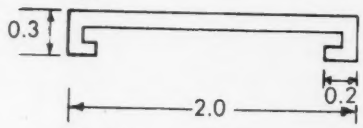

Fig. 9

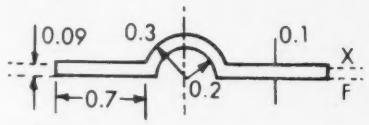

Fig. 10

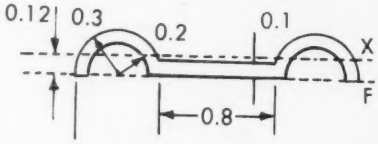

Fig. 11

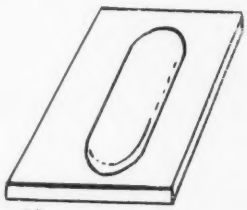
Fig. 12


Fig. 13

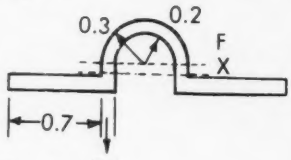

Fig. 14

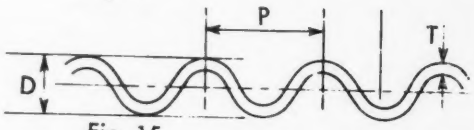

Fig. 15

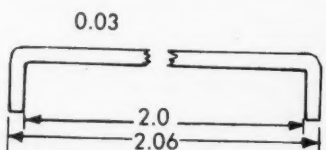

Fig. 16

(Continued on page 71)

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now obtained an increase in strength of about 640%. Compared to the solution with flanges, we find that the ribbed design employs 10% less material than the flanged design, yet provides over 10% increase in stiffness.

Ribs are often of the "closed" variety, i.e., entirely located within the panel of sheet metal. Since these ribs are formed by stretching the metal, there is a reasonably low limit to the results that can be obtained.

Corrugated panels

The cross-sectional shape of corrugated sheets may be considered as an uninterrupted series of conjugated ribs. The corresponding moment of inertia values depend upon the material thickness t, mean depth d, projected width b, and ratio between pitch and depth p. Manufacturers of such material usually give in their catalogues the calculated moment of inertia, or at least the proper formulae by which it may be calculated. A comparison of plain and corrugated sheets for strength gives some astonishing facts.

The Alcoa Structural Handbook gives:

$I_{xx} = kbtd^2$ and $k = 0.15$ when $p/d = 3$

$k = 0.13$ $p/d = 5$

Taking one standard type of corrugated sheeting, we have the following;

$p = 2.67$; $d = 0.875$; $t = 0.032$;

I_{xx} for one foot of width = 0.0409 inch^4;

$A = 0.469$ inch^2.

Now if we compare this data with that for flat panels we learn that:

1. The flat panels have about 20% less area for the same size sheet.

2. The strength of the corrugated sheet is about 1,250 times that of the flat sheet!

Composite shapes

We have been discussing only symmetrical components with one kind of reinforcing. Obviously it is quite possible, and practical, to design shapes where two or more different kinds of reinforcing are used. We have included sketches of some such shapes.

Of course, the calculation methods for these cases are similar to those employed for the more conventional and symmetrical pieces. Modifications must be made to allow for the variations, but these are quite straightforward.

We must point out that the very act of reinforcing may develop great internal stresses in the formed zones and thus affect the over-all strength of the stamping. It is therefore very important to check the actual forming operations to avoid such difficulties.

On the other hand, sometimes by coldbending of thin stock, the stock may become thinner; but the very act of thinning may increase the tensile strength because of the cold working effect. So, bent sections are usually stronger than straight ones. ★

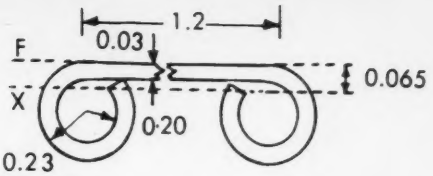

Fig. 17

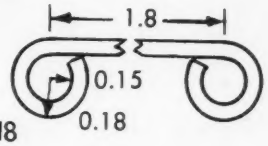

Fig. 18

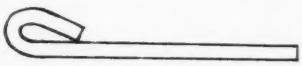
Fig. 19

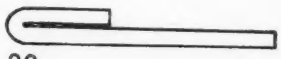
Fig. 20

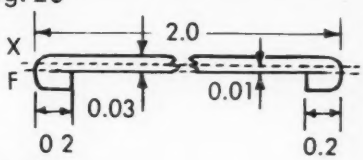

Fig. 21

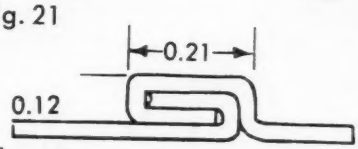

Fig. 22

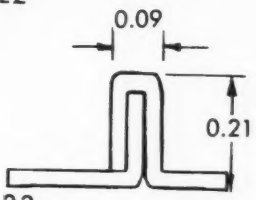

Fig. 23

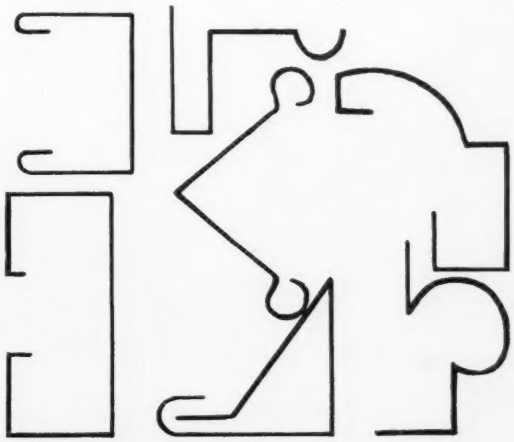
Fig. 24

1 *A new explosive forming process reduces welded footage by almost 40% in this torous tank which requires far fewer separate pieces than usual.*

2 *A charge of explosive cord, suspended in the water-filled preform, shapes space-age parts too large or difficult for existing presses. More than a dozen explosives are available.*

Exploding out-dated techniques

3 *Detonation of the explosive sends a geyser of water into the air and forces the metal into the shape of the die. Further tests aim at calculating the critical position of the charge relative to the preform.*

4 *The result is a donut-shaped tank which once resembled a cake pan. Research engineers from The Martin Company, Baltimore, have worked on the technique since January, 1960 and hope to reach production capabilities within a year.*

People . . .
. . . and events

New Design Council appointed

Appointments have been made to the National Design Council which was recently moved from the National Gallery to the Trade and Commerce Department.

The chairman is John C. Parkin, well-known Toronto architect who headed the old National Industrial Design Council.

The new council comprises seventeen members including Carl J. Lochnan,

Parkin

Lochnan

newly appointed director of the National Design Branch, Department of Trade and Commerce. Mr. Lochnan has had wide administrative experience in the civil service and was overseas representative for the National Film Board. In his new position he will "co-ordinate work programs initiated by the National Design Council, and will assist in the development of good design in industry.

Other members of the council are:

Industry and commerce

Morris Fisher, director Enterprise Foundry Co. Ltd., Sackville, N.B., manufacturer of heating appliances and household equipment.

Louis Philippe Poiré, vice-president Baribeau et Fils, Inc., Levis, P.Q., specialist in wooden products.

Carl A. Pollock, president Dominion Electrohome Industries Ltd., Kitchener, Ont., and vice-president Canadian Manufacturers' Association.

Harold Short, chairman Kenwood Mills Ltd., Arnprior, Ont., textile manufacturer.

Labor

Hugh J. Sedgwick, Canadian vice-president International Alliance of Theatre Stage Employees and Motion Picture Machine Operators, Hamilton, Ont.

Gaeton C. Morrissette, chairman Standard Brands Ltd., Montreal.

Frederick E. West, general manager B.C. division of T. Eaton Co. Ltd., Vancouver.

Architecture and engineering

D. Mordell, Dean of Engineering, McGill University, Montreal.

Prof. G. N. Soulis, Assistant Professor of Mechanical Engineering, University of Waterloo, Ont.

Clair Stewart, president Stewart and Morrison Ltd., Toronto, an eminent graphic designer.

General public

Mrs. C. H. J. Burrows, Regina, Sask.

Harold Sprague, president Sprague Furniture Co., Edmonton.

Public Service

Dr. B. Guy Ballard, vice-president Na-

Continued on page 74

tional Research Council and president Canadian Standards Association.

Dr. Charles F. Comfort, director National Gallery of Canada.

Edwin A. Gardiner, chief architect Department of Public Works.

New RCAF purchase

The RCAF is to get two new Canadian-designed jet aircraft for training pilots in high-speed, high-altitude flying.

They are Canadair CL-41's, the new single engine, side-by-side, two-seat jet trainers.

In announcing the purchase, Defence Minister D. S. Harkness said the RCAF had tested and evaluated most of the training aircraft available in the Western world before making its decision.

New pipe process

A Swedish method of producing reinforced plastic pipe will be introduced to North America by a new Toronto company.

Protective Plastics Ltd. has formed a subsidiary which is installing machines in its new plant to turn out pipe ranging from 18 inches to 72 inches in diameter. Machinery on order will make pipe from 4 inches up. The pipe can be made in any practical length—40 to 50 feet or even longer.

Main advantage claimed for the new pipe over concrete or steel is its extreme lightness, eliminating laying time and cost of heavy equipment.

Overseas mission

Donald C. McCormack, director of research & product development for J. A. Wilson Lighting Ltd., Toronto, represented Canada as Chief Delegate to the general assembly of the international Council of Societies of Industrial Designers in Venice, Italy, last month.

The International Council is made up of world-wide societies in the interests of establishing standards and exchanging information on the development of new products.

Capital spending

The metals industries have shown higher increases in most manufacturers revising their capital spending program for the remainder of 1961.

Forecasts by Dominion Bureau of Statistics shows the following:

Iron and Steel products — capital spending on new construction up by $6.4 million to $33.4 million; spending on new machinery and equipment down by $2.6 million to $111.4 million.

Non-ferrous Metal products — a small decrease in new construction, down by $700,000 to $23.5 million; while expenditures on plant machinery and equipment will soar by $4.6 million to $39.4 million.

Manufacturers of electrical and electronic apparatus have made a slight reduction in their capital spending plans. Estimates are down by $900,000 for the year.

Men on the move

George A. Browne appointed assistant director of the Industrial Development Branch, Department of Trade and Commerce, Ottawa.

G. W. Sparks joins RCA Victor Company Ltd. as Ottawa manager, technical products.

G. F. Parker has been given new responsibilities which include introduction and development of all new plastics for Monsanto Canada Ltd., Montreal.

Stanley

Browne

Davidson

McCormack

G. L. Gooding appointed manager of operations, D. J. Nickilo special projects engineer and Robert F. Scott chief inspector of Sparling Tank and Mfg. Co., Toronto.

John V. Stanley appointed assistant product manager, photo products, Du Pont of Canada Ltd.

Donald C. McCormack becomes director of research and development, J. A. Wilson Lighting Ltd., Toronto. Hedley F. Davidson joins the company as manager of engineering.

Hydraulic conference

The 1961 National Conference on Industrial Hydraulics will be held October 19-20 at the Sherman Hotel, Chicago. It is sponsored by Illinois Institute of Technology in co-operation with eleven engineering societies.

The Fluid Power Society will hold its annual meeting at the same location on the day preceding the NCIH show —Wednesday, October 18.

The NCIH conference will feature technical sessions covering such subjects as aircraft systems, automotive systems, pneumatics, pumps, hydraulic fluids, missile and space hydraulics. All associated with the fluid power field are urged to register early.

World expert speaks

Henton Morrogh, director of the British Cast Iron Research Association, Birmingham, England, will speak at the annual meeting of the Gray Iron Founders' Society to be held at Toronto's Royal York Hotel, October 18-20.

Mr. Morrogh will present a major address on current British research activities. He is well qualified for this because of long experience in metallurgy, especially graphite formation in cast iron. He will speak at the Thursday afternoon session and again at a special session on ductile iron at 3pm Friday.

R. W. Hale and H. W. Lownie, from Battelle Memorial Institute, will give a special progress report on a technical-economic research survey of customer industries.

DE's editor Doug Kaill, who is chairman of GIFS 1961 Design Contest judging committee, will present awards to the seven winners at luncheon on the Thursday.

NFPA may sponsor JIC

The National Fluid Power Association has initiated action to assume sponsorship of the Joint Industry Conference Hydraulic and Pneumatic Recommendations as a function of its Technical Board. Details of a transfer of sponsorship have not yet been completed. However, NFPA officials are negotiating with spokesmen for the automotive industry and intend to invite the participation of all other organizations which have an interest in standards related to the fluid power field.

NFPA President William C. Richards, Jr., said, "It is the intention of

People . . .
. . . and events *(Continued)*

NFPA to co-ordinate with other societies, organizations, users, and manufacturers in an effort to continue the program which was started by the automotive companies some years ago, with the purpose in mind that such pneumatic and hydraulic recommendations can eventually become ASA Standards recognized by ASME, ASTME, NMTBA, SAE, AMA, and other interested agencies."

A parallel decision also made at the recent meeting of the NFPA Board of Directors was to establish a committee to work with the American Standards Association (ASA), the International Standards Organization (ISO), and other agencies concerned, on recommended fluid power standards.

41 U. K. fellowships

Forty-one young Canadian engineers will again be selected for two years' training in industrial establishments or universities in the United Kingdom under the annual Athlone Fellowship Scheme.

Sixteen Canadian universities which grant degrees in engineering have their own Selection Boards for the Awards. This year these Boards will be meeting in October, November and December—beginning at Montreal's McGill University and Ecole Polytechnique on October 30.

Traveling across Canada to represent the United Kingdom on the Boards will be F. E. A. Manning, Adviser to the Managing Committee of the Athlone Fellowship Scheme, and D. J. McCarthy, First Secretary, United Kingdom High Commission in Canada.

The Scheme began in 1951 and so far there have been some 380 awards. Fellows go to Britain for two years to follow programs of advanced practical work or research. The awards, financed by the United Kingdom Government, cover travel costs, living expenses and any academic fees involved. They are granted on the understanding that their holders will afterwards return to Canada to follow their careers.

The Athlone Fellowship Committee in the U.K.—representative of industry, the universities and the Government—arranges for the reception and placing of the Fellows and is concerned with their welfare and progress throughout their stay in the country.

Of the total 41 Fellows to be selected, 31 will be recent graduates in engineering and 10 will be engineers who have already been employed in industry.

Nuclear contract

A contract to build the huge reactor vessel for Canada's first commercial nuclear generating station has been awarded to Dominion Bridge Company Ltd.

The vessel, known as a calandria, will comprise a stiffened cylindrical stainless steel shell 19 ft 10 in. in diameter, 16 ft 1 in. long and 1 in. thick. Tube sheets at each end, also of stainless steel, are 1½ in. thick. Forming the lower part of the shell is a dump port with a labyrinth-type 12 by 10 inch opening.

The calandria will be the central component of the CANDU reactor which will employ natural uranium as fuel.

Technical literature

Servo valves—Bulletin on single stage servo valve for use in electro-hydraulic servo systems. Vickers-Sperry of Canada Ltd.
Circle 326 on Reader Service Card

Silicones—8 page catalogue describing a complete line of silicones with a complete selector guide for silicone rubber. Canadian General Electric Co.
Circle 327 on Reader Service Card

Alloy chart—Folder describing a complete line of copper-base, stainless steel and nickel-base alloys. H. K. Porter Co. Inc.
Circle 328 on Reader Service Card

Hydraulic accumulators — A guide to the operating principals, designs and uses. All types are discussed including piston, mechanical bellows, spring loaded, aircraft and bladder types. Greer Hydraulics Inc.
Circle 329 on Reader Service Card

Hydraulic sprinklers — Circular describing a revised manual dealing with design of fire protection systems. Automatic Sprinkler Co. of Canada Ltd.
Circle 330 on Reader Service Card

Compression tube fittings—New catalogue presenting 25 items with illustrations and dimensions. Parker-Hannifin Corp.
Circle 331 on Reader Service Card

Russian translations—Literature describing translations available on latest developments in Soviet science and technology. British Department of Scientific & Industrial Research.
Circle 332 on Reader Service Card

Lighting louvres—Catalogue incorporating several new features of vinyl luminous ceiling panels. J. A. Wilson Lighting Ltd.
Circle 333 on Reader Service Card

Phenolics—Illustrated folder giving the guide lines for designing with phenolic molding compounds. General Electric Co.
Circle 334 on Reader Service Card

2-Way valves—A bulletin describing a new series of miniature 2-way valves designed for high capacity in small envelope size. Airmatic Valve Inc.
Circle 335 on Reader Service Card

Precision switches—Brochures specifying 42 precision switch packages and thermostat packages. Texas Instruments Inc.
Circle 336 on Reader Service Card

Circuit breaker chart—Selector chart featuring new rotary handle molded case circuit breakers in four frame sizes covering the 15 to 800 amp range. Federal Pacific Electric of Canada.
Circle 337 on Reader Service Card

Vibrating screens — Booklet describing rotary vibrator screens, grizzly bar screens, screening feeders, mechanical conveyor screens and pulsating magnet screens. Syntron (Canada) Ltd.
Circle 338 on Reader Service Card

Metals information—Brochure describing American Society for Metals' new electronic system for searching technical articles, documents and patents on any specific subjects.
Circle 339 on Reader Service Card

Rubber deflashing—A bulletin describing a major new development in mechanical rubber deflashing. Wheelabrator Corp. of Canada Ltd.
Circle 340 on Reader Service Card

Continued on page 78

Technical literature *(Continued)*

Pneumatic current controllers—Data sheet describing a pneumatic-electric transducer affording automatic regulation of current, voltage, resistance, inductance and capacitance. Conoflow Corp.

Circle 341 on Reader Service Card

Resistance ratio accuracy—Bulletin establishing a primary resistance ratio reference accurate to one part in ten million. Julie Research Laboratories Inc.

Circle 342 on Reader Service Card

Laboratory instruments — Catalogue showing a complete line of more than 18,000 instruments and equipment for research, education and industry. Cenco Instruments Corp.

Circle 343 on Reader Service Card

Strain recording—Booklet describing application of strain gauges and strain gauge based transducers for recording strain, tension, thrust, load and torque. Brush Instruments.

Circle 344 on Reader Service Card

Directional control valves—Bulletin describing a complete line of two, three and four-way directional control valves for pressures up to 3,000 psi. Oilgear Company.

Circle 345 on Reader Service Card

Cellular ceramics—Brochure on thin-walled structure developed for varied high temperature uses. Corning Glass Works.

Circle 346 on Reader Service Card

Gear and pinion—Catalogue incorporating the newest combinations of die cast zinc alloy, one-piece gear and pinion combination. Gries Reproducer Corp.

Circle 347 on Reader Service Card

Rod ends—Catalogue describing an expanded line of rod ends and spherical bearings. Miniature Precision Bearings Inc.

Circle 348 on Reader Service Card

Microwave absorbers—File-folder chart presenting data on properties and uses of absorbers in both waveguide/coax applications and free-space microwave anechoic chambers. Emerson & Cuming Inc.

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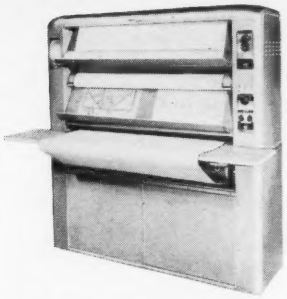

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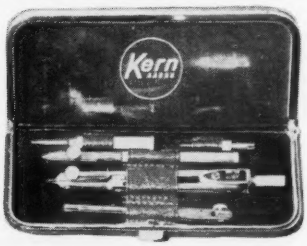

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Case against decentralization

DE's Ottawa correspondent Richard Gwyn reports . . .

Businessmen who reject the pleas of community planners and locate new factories in metropolitan centres are probably doing the right thing.

Prof. D. W. Slater of the economics and political science department of Queen's University backs them in a paper he's prepared for the October "Resources for Tomorrow" conference in Montreal.

He poses the question: "One of the persisting mysteries of industrial location concerns the limited amount of decentralization that has actually taken place."

He lists a large number of advantages for new industries to locate in smaller or medium-sized towns:

Since modern continuous-flow production processes are best organized in a one-story building savings can be made on land costs in smaller towns; the increasing importance of industrial water supplies as well as disposal of wastes make location in big cities more difficult; modern methods of transportation and communication make smaller towns far less isolated; big cities mean higher wage rates, higher taxes as well as higher land costs; and there are diseconomies of congestion in large centres.

Nevertheless, he continues, there are solid advantages to operations in big cities which can outweigh these benefits.

A concentration of industries makes for flexibility in the face of changing markets or products. "The opportunities for fine marginal adjustments, the safety margins that are permitted by short-term contracts for staff, space, intermediate products and sales arrangements, the access to a wide variety of export help which can be bought in small market, the intimate and speedy contact with the most important markets and opportunities for intense specialization, for many industries these are enormous attractions and big cities fill the bill."

Don't copy designs

What's the key to the success of the 18-month-old export drive by Vendomatic Ltd., Toronto, manufacturers of hot and cold drink vending machines?

The question was put to Allan D. Baker, executive vice-president, by officials of the Trade Department.

His answers:

- "Don't copy other people's designs." Canada has plenty of designing talent that needs only a chance to show what it can do, he says. "Design your own product and then make sure it can be produced at a competitive cost."
- "If you can't sell complete machines try to sell components for them." You remain in control and your firm gets export orders, Mr. Baker reports. (Vendomatic has adopted this principle in the U.S.; sells complete machines to the West Indies.)
- Sell hard and remember salesmanship is the same abroad as in Canada.
- Never give up on a foreign market until you've visited it and tested sales prospects for yourself.

Vendomatic is lining up orders in the United States and the Caribbean and is currently planning a sales campaign in Western Europe.

Help for licensees

The government has acted to help companies considering manufacturing items in Canada under license from foreign patentees.

Changes have been made to the Temporary Entry Remissions Order which provides for repayment of all but 1/60th of the original duties and taxes paid on items such as molds, dies, equipment, machines and vehicles imported solely for determining whether they should be manufactured in Canada and then re-exported once examination is completed.

The regulation permitting entry of instruments and other apparatus for testing machines has been relaxed to allow entry of these items to be used on machines in Canada. Previously the regulation applied only to machines "previously imported".

Imports of machines, vehicles and equipment by the federal government for testing purposes will be expanded to allow entry of both commercial as well as defence items.

A new section has been added allowing remission of duties for:

"Equipment of a class or kind not made in Canada, imported for examination purposes, by Canadian manufacturers, to determine the technicalities involved in manufacturing similar equipment in Canada."

Officials report that numerous requests for this concession have been made by the electronics and home appliance industries.

Briefs

Plastics: The familiar steel drum for floating barges, docks and boathouses may be a thing of the past according to a Texas manufacturer who has put out a molded **expanded polystyrene** foam cylinder, reinforced with galvanized mesh wire, which will support 480 pounds dead-weight and last longer than the drum . . . a light, unbreakable 13-gallon bottle for industrial and consumer storage of liquids is one of the first commercial products of the recently developed plastic **technology** called polyethylene powder molding . . .

Bionics: That's the study of applying the findings of the life sciences to the work of the engineer and the physical scientist; and it's the subject of a recent symposium at Cornell University where 300 scientists met to discuss the organisms of **baby chicks,** leaves and frogs and apply them to man-made radar . . . one experimental machine described employs processes patterned after those used by a **frog** in spotting and capturing insects . . . there was a paper on a typewriter which **hears, spells** and records the spoken word with the use of a microphone and a syllable memory . . . and a surgeon related the number of patients admitted to hospitals for **psychiatric disturbances** to an increase in the number and intensity of electrical storms . . .

Rocket rattling: Man's best friend was certainly not the **mongrel mascot** that mistook a rocket igniter for a fire hydrant at a rocket manufacturing site in California recently; when the rocket failed to ignite the diagnosis was foreign matter in the igniter — guess what . . . engineers report that standardized chassis building blocks may hold the key to more **reliable** and less costly missile system checkout . . . a new motor with air bearings that runs indefinitely, never needs oiling and can spin 5,000 times in the **flick of an eyelid** is being manufactured in the U.S. for possible use in everything from missiles to household refrigerators . . .

Metal news: If the aluminum industry does convince the automakers that **liberal use** of the material could carve 510 unnecessary pounds from a two-ton car, average city motorists could expect 600 more miles annually for the same fuel ependiture . . . producers of marchant **pig iron** in the U. S. have financed a survey to determine current and future uses for gray and ductile iron castings . . . a British-built Bristol Type 188 aircraft, with 90% stainless steel airframe will be flown at **1500 mph** under skin temperatures of 536 F to answer design problems facing engineers . . . a new, faster **steel-cutting** method adopted in England enabled a propane-oxygen flame to cut a four-ton, 31 inch thick core from a circular steel forged wheel (five feet in diameter) in only 40 minutes . . . Atlas Titanium Ltd. at Welland, Ont. is erecting Canada's only commercial **vacuum melting** furnace for producing large ingots of steel, titanium or zirconium . . .

Communications: The U. S. Army is to test The Martin Company's new radio-telephone system which will allow scores of users to talk over a single frequency channel by merely **dialing** their number, as with a telephone . . . Donald C. Power, chairman of General Telephone and Electronics Corp. says satellites will be the only answer to handling the estimated increase of the world's **overseas** telephone calls from the present 2,000,000 per year to more than 10,000,000 by 1970 . . .

Talepiece: This quote was taken from the official transcript of evidence given by a company president under cross-examination by officials of the Combines Investigation Branch. "**Question.** Do you still have what is called preferred dealers at the present time? **Answer.** "Well, as soon as I walked into my office after my holidays and found these investigators, anybody is preferred. We sell anybody, anything, at any price, any time."

"Do you always use the same centre point for drawing arcs?"

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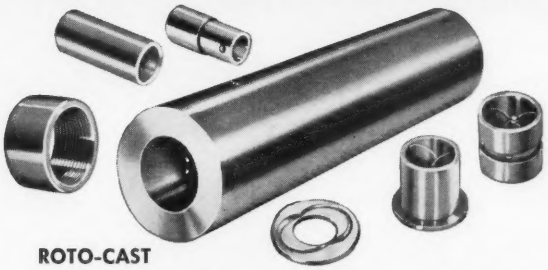

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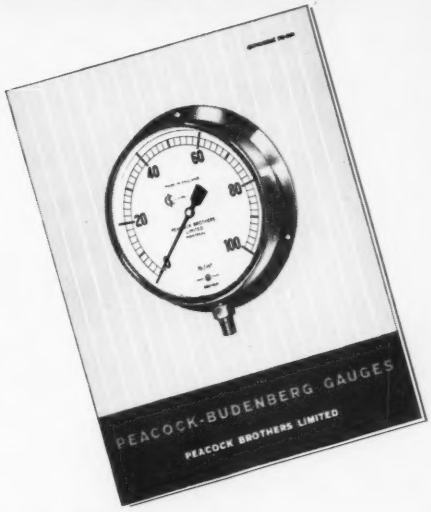

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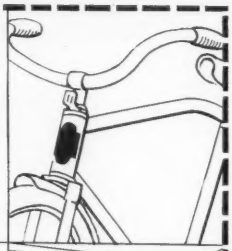

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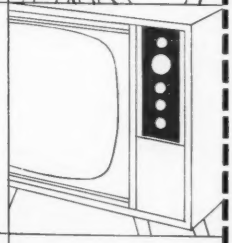

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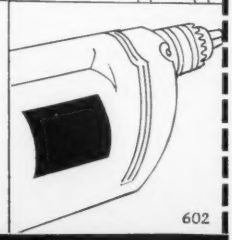

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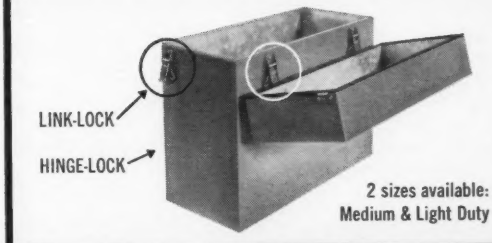

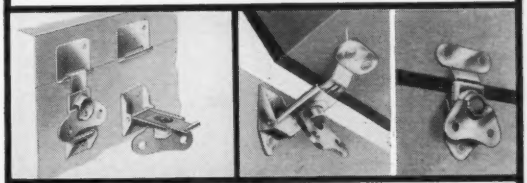

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backlash

New product idea

Here's a chance for Canadians to jump on the band wagon and develop a saleable new product which should get a big push from the current Berlin crisis. Builders are exploiting the public's fear of nuclear attack to make money from fallout shelters. Now a U. S. firm has announced a household radiation detector for civilian use.

In Canada, where such instruments are now confined to the scientific and industrial market, there is a big opportunity presenting itself. Surely adaptation for general consumer appeal is not a difficult chore. The American firm sees such scope for its newly designed product that it will distribute through regular hardware, department store and appliance store channels.

Shed our inhibitions

There's been a lot of talk lately in these columns, as well as everywhere else, about the need for a Canadian national identity. Canadianization has been urged in all fields from business finance to engineering design. But here's a fresh approach on the "problems" facing the tourist industry. The Canadian Manufacturers' Association, in its newsletter "Industry", quotes some suggestions written by an American tourist after a friendly trip to Ontario and Quebec:

"But why do so many business establishments name their businesses after U. S. places, fly the U. S. flag and serve U. S.-style foods? The average U. S. tourist comes to Canada to see things and eat foods he cannot see or eat back home. When he comes up to Canada he sees Old Glory flying from every flagpole, restaurants featuring Southern Fried Chicken and Idaho potatoes. If things are going to be the same as back in the States then we might as well stay home."

"Industry's" well-measured reflections are: "Let us concentrate less on being imitative and more on being ourselves . . . What is the point in having a separate national identity if we do not?"

Canada can help U.S.

Leading government officials from both sides of the border attended a simple ceremony in Galt, Ontario on September 14th marking a unique Canadian-U. S. venture designed to get a U. S. company back into one of the world's fastest growing markets. The secret: realization that a Canadian company could produce at a cost to permit competitive prices while the U. S. company found its costs spiralling. Of course, it took a complete redesign of the product to allow production on the Canadian facilities, but this resulted in an even better product.

The Canadian partner in the venture is the R. McDougall Co., a division of Upton, Bradeen and James — a long time manufacturer of specialty machinery. The American partner is the Lawson Company, who have been one of the best known names in the manufacture of paper-cutting machinery for printers, binderies and the paper industry. Low priced machines of foreign manufacture had reduced this firm's export trade to zero, and had almost eliminated their domestic market as well.

The new cutters will contain hydraulic and electrical components brought in from the U. S. . . . but almost 70% of the machine will be made in Canada. Thus, the new machines, made in Canada, will enable the U. S. company to compete on an equal price basis with paper cutters manufactured anywhere in the world.

Mr. B. G. Barrow, Canada's Assistant Deputy Minister for Trade and Commerce, lauded the new venture as an example of what can be done by private industry. The economy of both countries will benefit . . . and Canada is enabled to enter the graphic arts machinery field.

Undoubtedly there are many other products where a similar arrangement for manufacture in Canada would bail out some American company . . . with mutual benefit to all.

Better the standards

A Canadian steel manufacturer has supplied us with a piece of news of the type which, unfortunately, we see far too seldom. The Algoma Steel Corporation Limited, Sault Ste. Marie, Ontario has found that certain of its steels have been exceeding the minimum specified yield strength by a considerable margin. It is now in a position to offer steels of Specification CSA G40.8 with guaranteed minimum yield strengths 4,000 psi higher than those laid down by the standard. The big thing: no extra cost.

Now minimum yield strengths guaranteed will range from 44,000 psi for ⅝-inch thickness to 40,000 psi for 1 to 1½-inch thickness.

Standards, it seems, are meant to be broken. So long as it is an improvement, of course.

Wives have their say

A meeting of the wives of 1950-51 engineering graduates from the University of Toronto just over 10 years ago was the starting point of a very significant move for the furthering of technical education. Thanks to the womenfolk, three Toronto youths have embarked on the first year of their engineering courses at the University of Toronto.

The students are the recipients of $500 bursaries awarded by the Professional Engineers' Wives Association which grew from the original meeting back in 1950. So far $5,000 has been distributed in bursaries as a result of fashion shows and auction sales. But this year is a little special. It's the first time they've been able to present three bursaries at once.

With more support the 110 women can bolster their present admirable effort, and in any case they offer a shining example which could be followed by engineers' wives in other centres.

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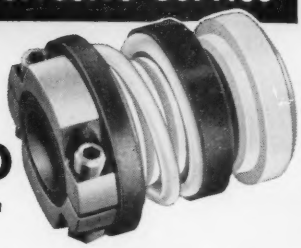

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Editorial

Industrial design moves ahead in Canada

. . . are you prepared for its new and expanding influence?

Canadian industry will, in the near future, be according greater recognition to the role of the industrial designer.

This is the good word we have from Mr. B. G. Barrow, Assistant Deputy Minister (Domestic Commerce) in the Department of Trade and Commerce. And he's the man that should know . . . for it is under his aegis that the government's promotional activities in the fields of engineering and industrial design are undergoing a major reorganization.

Important events certainly are taking place today in these areas of Canada's industry. No less than three of them are recognized by editorial coverage within the pages of this issue of DE.

But before we start applauding too loudly, let's take a closer look at the situation.

The University of Waterloo, the school that dares to jump in where others fear to tread, has introduced another new and excellent idea into its curriculum for engineers. Professor Soulis, in his article commencing on page 40, provides some sound reasoning why the education of the industrial designer should be taken out of the hands of the arts and crafts schools, and put under the control of the schools of engineering. **At Waterloo they even expose the tyro engineer to a series of lectures on industrial design.**

What we cannot understand is why some of the older universities of our country have not recognized the value of such a move long ago. Perhaps they did recognize it . . . but chose to ignore the truth. Or maybe it's just the powers-that-be at Waterloo are not so bound up with tradition that their very progress is stifled. Would that there were more Waterloos.

Approximately one year ago the politically-oriented and arty-minded body known as the National Industrial Design Council was transferred from the patronage of the National Gallery to the more virile and frugal atmosphere of the Department of Trade and Commerce. Everyone concerned realized that a new concept of the function of the Council was called for . . . in fact a whole new program was needed. No longer should this important facet of Canadian culture and economy be the sole interest of the artist and the home decorator. It must be, as it is in many countries with which we must compete for world trade, another tool for forging products of improved saleability and increased profits.

Well, we have a new organization, called the National Design Council (note that the word industrial has been dropped). We also have a new man as Director, in the person of Carl J. Lochnan, a career civil servant. (See page 73).

But will the promised revitalization take place? Will this new group provide the aggressive leadership that is so urgently needed?

The new Council, for instance, could not be readily described as a 'working council'. Their senior positions in management and education, for instance, leave them little time for the detailed work necessary for the Design Branch to fulfill its proper function. It is significant also that no practising design engineer or industrial designer has been included in the group. We can only assume that a number of 'working committees' will be appointed to back up this Council . . . such an arrangement could be the ideal antidote to the ineffectiveness of the previous Council.

We join with thousands of other Canadians who wish Mr. Barrow and his cohorts every success in their new venture. We wish them success because somehow we feel that our very livelihoods may depend upon it.

Doug Kaill

TO PLUMB NEW DEPTHS IN SOUND,

Northern Electric Research and Development Laboratories built a floating anechoic chamber. Although the appearance of this room is weird, its purpose is perfection; for here, there are no echoes, reflections or vibrations to distort the accuracy measurements of sound waves. ■ Wedges of Fiberglas, five feet long, project towards the middle of the room from all six surfaces, so that the equipment under test is completely surrounded by a mass of sound absorbent material. ■ This anechoic chamber is being used to test microphones, speakers, telephone transmitters and receivers, intercom systems and other communications equipment. ■ The chamber is an important new asset, but it represents just a fraction of the total facilities and personnel dedicated to the quest for progress in communications at the Research and Development Laboratories of Northern Electric Company Limited.

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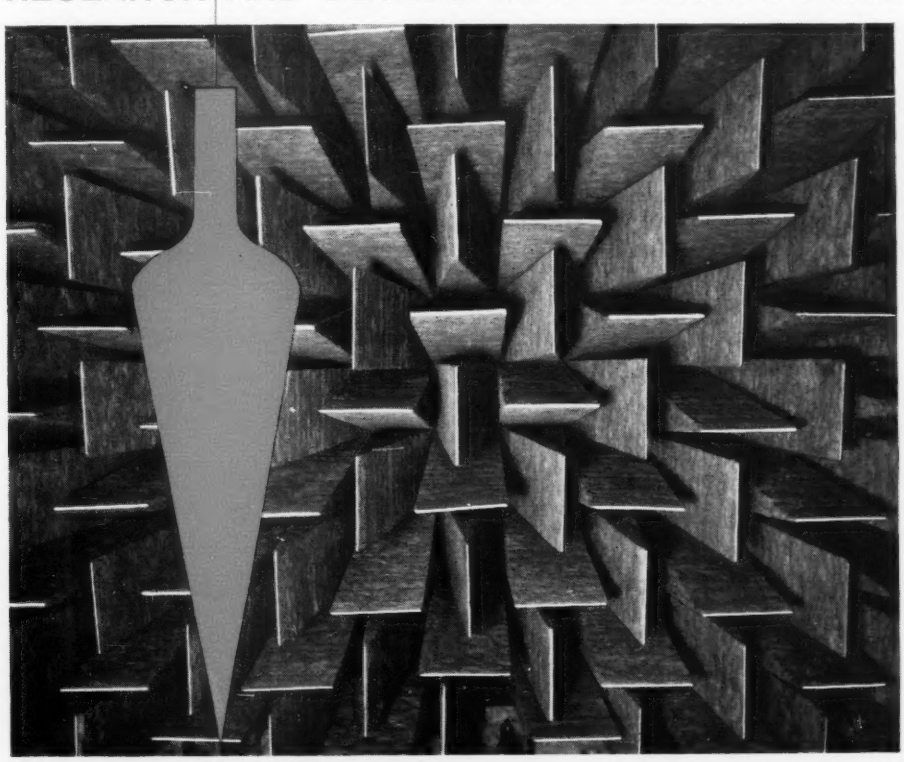

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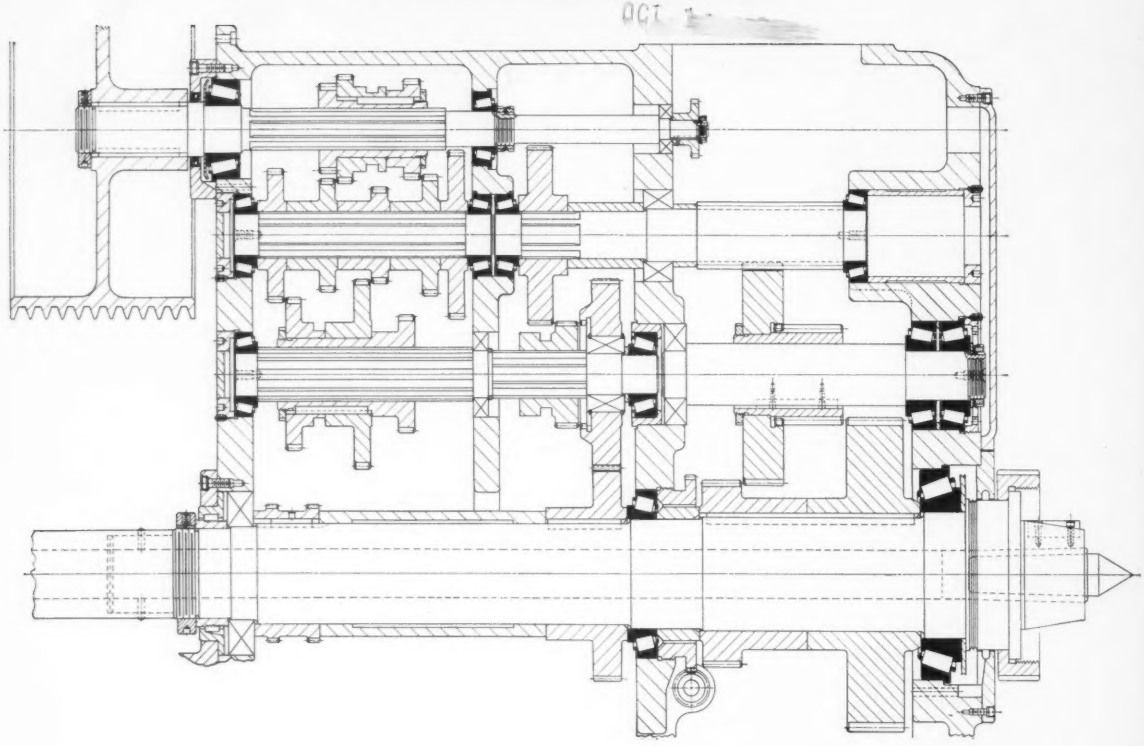

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